

**WATER MANAGEMENT PROGRAM**  
**WATER PROTECTION REPORT**  
(Effect of Discharges on Receiving Water)

PROJECT DESCRIPTION:

☐  
☒

New Discharge  
Renewal

☐  
☐

Change  
Preliminary

Application/Permit No: PA 0008281

Applicant, Case Name or Permittee: PPL Brunner Island

Municipality: East Manchester Township

County: York

Type Waste:

☐  
☒

Sewage  
Industrial Waste

☐  
☒

Mine Drainage  
Wastewater Flow 795 MGD

USGS - Q: York Haven

Latitude: 40°05'29"

Longitude: 76°41'15"

File Code: 1832

Method: Pennsylvania DEP eMap

WATER USES AND CRITERIA:

Stream Code: 06685

RMI: 40.05

Sub-basin: 7-F/H

Receiving Waters: Susquehanna River

D.A.: 25,500 sq. mi.

Flow: 3100 cfs

Water Uses Protected:

Exceptions to Specific Criteria:

- ☒ WWF (Chapter 93)  
☐ Dry Stream  
☐ Impoundment  
☐ Other (Explain)

List: O

- ☒ None  
☐ Add: \_\_\_\_\_  
☐ Delete: \_\_\_\_

Secondary Water: Chesapeake Bay

D.A.: \_\_\_\_ sq. mi.

Flow: \_\_\_\_ cfs

Water Uses Protected:

Exceptions to Specific Criteria:

- ☐ TSE (Chapter 93)  
☐ Dry Stream  
☐ Impoundment  
☐ Other (Explain)

List: O

- ☒ None  
☐ Add: \_\_\_\_\_  
☐ Delete: \_\_\_\_

APPROVALS:

Reviewer/Permit Engineer: \_\_\_\_\_

Date: \_\_\_\_\_

Hydrogeologist/WQ: \_\_\_\_\_

Date: \_\_\_\_\_

Aquatic Biologist/WQ: \_\_\_\_\_

Date: \_\_\_\_\_

Chief of Permitting/WQ: \_\_\_\_\_

Date: \_\_\_\_\_

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

## 1. Introduction

The Pennsylvania Power & Light (PPL) Generation, LLC operates a 1,490 megawatts<sup>1</sup> coal fired power plant along the western shore of the Susquehanna River in East Manchester Township, York County Pennsylvania. The coal fired power plant, known as the Brunner Island Steam Electric Station (BISES), uses three boiler units.<sup>1</sup> Unit 1 began operation in 1961 and has a generating capacity of 325 megawatts; Unit 2 began operation in 1965 and has a generating capacity of 384 megawatts; and Unit 3 began operation on 1969 with a generating capacity of 781 megawatts.<sup>1</sup> The PPL BISES site discharges various wastewater and stormwater flows under the NPDES permit, PA0008281, which was previously issued on September 1, 2006 (permit cycle October 1, 2006 to September 30, 2011) with two subsequent amendments on April 2, 2007 and September 24, 2008. The PPL BISES operates under SIC Code 49 or NAICS Code 221 and is classified by the Pennsylvania Department of Environmental Protection (PA DEP) as a Major Facility greater than or equal to 250 MGD.

The PPL BISES site treats a variety of industrial wastewaters and sewage onsite with sludge residuals landfilled, sold or hauled offsite for further processing. Currently, the BISES site has six active wastewater discharge outfalls, one outfall permanently closed and a new outfall pending. The outfalls are listed below with a brief description and location.

<b>Table 1-1. Wastewater Outfall Location</b>				
Outfall No.	Latitude	Longitude	Flow (MGD)	Description of Discharge
001	40°05'29"	76°41'15"	795.0	Condenser Cooling Water Discharge
002	40°05'59"	76°41'42"	2.0	Incidental Waste Treatment Basin
003	40°05'58"	76°41'40"	0.032	Sewage Treatment Plant
004	40°04'37"	76°40'40"	4.8	Ash Basin No. 6
005	40°05'41"	76°41'36"	n/a	Permanently Closed
006	40°05'15"	76°41'43"	0.180	Groundwater
007	40°05'32"	76°41'23"	0.210	Flue Gas Desulfurization IWTP
008 (New)	40°05'29"	76°41'15"	5.5	New IWTP

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The BISES site also has 18 existing stormwater outfalls and three new stormwater outfalls that are to be included with the NPDES renewal.

<b>Table 1-2. Stormwater Outfall Location</b>			
Outfall No.	Latitude	Longitude	Discharges To:
009	40°05'40"	76°42'08"	Wetlands to Conewago Creek
010	40°05'09"	76°41'04"	Susquehanna River
011	40°05'19"	76°41'37"	Black Gut Run (aka Hartman Run)
012	40°06'01"	76°41'55"	Susquehanna River
013	40°05'49"	76°41'32"	Susquehanna River
014	40°05'51"	76°41'34"	Susquehanna River
015	40°05'31"	76°41'21"	Susquehanna River
016	40°05'17"	76°41'40"	Black Gut Run (aka Hartman Run)
017	40°05'06"	76°41'33"	Black Gut Run (aka Hartman Run)
018	40°05'09"	76°41'26"	Black Gut Run (aka Hartman Run)
019	40°05'02"	76°41'22"	Black Gut Run (aka Hartman Run)
020	40°04'57"	76°41'17"	Black Gut Run (aka Hartman Run)
021	40°04'53"	76°41'17"	Black Gut Run (aka Hartman Run)
022	40°04'49"	76°41'12"	Black Gut Run (aka Hartman Run)
023	40°04'40"	76°40'56"	Black Gut Run (aka Hartman Run)
024	40°04'34"	76°40'44"	Black Gut Run (aka Hartman Run)
025	40°04'54"	76°40'50"	Susquehanna River
026	40°05'53"	76°42'07"	Conewago Creek

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

027 (formerly 008)	40°05'46"	76°41'32"	Susquehanna River
028 (New and same location as 007)	40°05'32"	76°41'23"	Susquehanna River
029	40°05'36"	76°41'30"	Susquehanna River
030	40°05'34"	76°41'27"	Susquehanna River

Attachment A shows the location of each wastewater and stormwater outfall. Outfall 008 was previously a stormwater outfall; however, to keep all of the wastewater discharge outfalls together, the stormwater outfall is renumbered as Outfall 027. Outfall 008 will now be associated with the discharge from the new IWTP.

In an effort to further meet State and Federal regulations, PPL has recently spent approximately \$860 million on plant upgrades including a 34 cell mechanical draft cooling towers (completed in the Spring of 2010), new scrubbers and an industrial wastewater treatment plant designed to treat the scrubber wastewater (completed in the Spring of 2009) and new electrostatic precipitators for Units 2 and 3<sup>2</sup>. As a result of the new scrubber system, the BISES site also generates several thousand tons of synthetic gypsum per year, which is held on site until it is transported to an offsite processor.

1. PPL Brunner Island Fact Sheet. PPL Corporation. (2011).  
<http://www.pplweb.com/ppl+generation/coal+plants/ppl+brunner+island+-+fact+sheet.htm>. Retrieved on September 12, 2011.
2. Inside Brunner Island. PPL Corporation . (2010). Adobe PDF.  
<http://www.pplweb.com/ppl+generation/coal+plants/ppl+brunner+island+newsletters.htm>. Retrieved on September 12, 2011

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 2. Compliance History

Since the previous NPDES renewal the facility has been inspected ten times. The notes of those inspections are as follows:

**February 9<sup>th</sup>, 2006** the Department's inspector, Durand Little, noted that all units and equipment were in normal operation and that pH, TRC, D.O., temperature monitoring was okay. The IWTB final discharge was slightly cloudy in appearance and the pH was okay. The STP final effluent was clear and all field test were okay. Mixed liquor was dark brown and settleability was good. The Ash Basin No. 6 discharge was slightly cloudy with okay pH.

Table 2-1. Outfall 002 Incidental Waste Treatment Basin						
Flow	1.40	MGD		Temp	2.8	°C
pH	6.99	S.U.		TSS	8	mg/L
D.O.	10.40	mg/L				

Table 2-2. Outfall 003 Sewage Treatment Plant						
Flow	0.016	MGD		NO <sub>2</sub> -N	0.01	mg/L
pH	7.84	S.U.		NO <sub>3</sub> -N	22.16	mg/L
D.O.	11.7	mg/L		TKN	1.16	mg/L
Temp	8.0	°C		TN	26.25	mg/L
TSS	2	mg/L		TP	0.252	mg/L
TRC	0.2	mg/L		Fecal Coliform	20	CFU/100 mL

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 2-3.** Outfall 004 Ash Basin No. 6

Flow	0.016	MGD		Chromium	0.050	mg/L
pH	7.49	S.U.		Copper	0.010	mg/L
Temp	8.5	°C		Iron	0.667	mg/L
TSS	10	mg/L		Manganese	0.018	mg/L
Aluminum	0.843	mg/L		Nickel	0.050	mg/L
Arsenic	0.0128	mg/L		Zinc	0.010	mg/L

**August 2<sup>nd</sup>, 2006** the Department's inspector, Durand Little, conducted a follow up inspection of the condenser cooling channel and on-going foam generation. Observations were similar to previous site visits on July 21<sup>st</sup> and July 25<sup>th</sup> in regards to foam patches with pockets of accumulated material along the edge. Rechecked the temperature of the channel the results are below.

**Table 2-4.** Channel Observations

Temp		TRC		Note
113.5	°F	0.04	mg/L	Condenser Channel Confluence
117.2	°F	0.05	mg/L	Unit No. 1 & 2 Discharge
113.5	°F	0.05	mg/L	Unit No. 3 Discharge
93.0	°F	-	-	Conewago Creek confluence upstream

Facility was in compliance with NPDES permit parameters and no unusual conditions were noted upstream. The York Haven STP was in compliance. It was noted that the foaming was suspected to be a result of the chlorine and bromine content and aeration affect from pumping discharge.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

Table 2-5. Water Quality Sampling			
TP	0.035	mg/L	Condenser Channel
TP	0.115	mg/L	Conewago Creek Boat Launch

**July 16<sup>th</sup>, 2007** the Department's inspector, Durand Little, wrote that all units and equipment were in normal operation. The only compliance issue in recent past was TRC in condenser discharge channel.

Table 2-6. Outfall 002 Incidental Waste Treatment Basin					
Flow	-	MGD		Chromium	0.050 mg/L
pH	7.22	S.U.		Cooper	0.010 mg/L
D.O.	-	mg/L		Iron	0.489 mg/L
Temp	-	°C		Lead	0.001 mg/L
TSS	2	mg/L		Nickel	0.050 mg/L
Aluminum	0.267	mg/L		Mercury	0.001 mg/L
Arsenic	0.003	mg/L		Molybdenum	0.070 mg/L
Boron	0.200	mg/L		Selenium	0.007 mg/L
Cadmium	0.010	mg/L		Zinc	0.024 mg/L

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

**Table 2-7. Outfall 003 Sewage Treatment Plant**

Flow	-	MGD		NO <sub>2</sub> -N	0.01	mg/L
pH	7.89	S.U.		NO <sub>3</sub> -N	12.91	mg/L
D.O.	7.45	mg/L		TKN	1.00	mg/L
Temp	28.5	°C		NH <sub>3</sub> -N	0.04	mg/L
TSS	4	mg/L		TP	0.462	mg/L
TRC	0.01	mg/L		Fecal Coliform	10	CFU/100 mL
BOD <sub>5</sub>	1.50	mg/L				

**Table 2-8. Outfall 004 Ash Basin No. 6**

Flow	-	MGD		Chromium	0.050	mg/L
pH	7.22	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.103	mg/L
Temp	-	°C		Lead	0.001	mg/L
TSS	2	mg/L		Nickel	0.050	mg/L
Aluminum	0.200	mg/L		Mercury	0.001	mg/L
Arsenic	0.0083	mg/L		Molybdenum	0.070	mg/L
Boron	0.200	mg/L		Selenium	0.007	mg/L
Cadmium	0.010	mg/L		Zinc	0.010	mg/L



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 2-9.** Outfall 006 Groundwater Discharge

Flow	-	MGD		Chromium	0.050	mg/L
pH	7.30	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.315	mg/L
Temp	-	°C		Lead	0.001	mg/L
TSS	2	mg/L		Nickel	0.050	mg/L
Aluminum	0.200	mg/L		Mercury	0.001	mg/L
Arsenic	0.0083	mg/L		Molybdenum	0.070	mg/L
Boron	0.200	mg/L		Selenium	0.0144	mg/L
Cadmium	0.010	mg/L		Zinc	0.082	mg/L

**October 18<sup>th</sup>, 2007** the Department's inspector, Durand Little, investigated a fish kill in the condenser channel due to thermal stress (in-stream temperature increase) associated with Unit No. 3 ramp-up process. The fish kill was reported by Pennsylvania Fish & Boat Commission representative, Darrin Kephart. Mr. Kephart had responded on at 14:30pm on October 17<sup>th</sup>, 2007 to a citizen complaint. Mr. Kephart notified PPL personnel at 15:50 and reported 2,600 dead fish.

During sit down meeting with PPL Safety, Health and Environment Supervisor, Rob Fultz and PA Fish & Boat Commission representative, Darrin Kephart, Mr. Foltz explained that the Unit No. 3 intake bar rake mechanism had been damaged. Additionally, Mr. Foltz shared thermal data related to days bracketing the fish kill incident. It was noted that Unit No. 3 reduced production on afternoon of October 16<sup>th</sup>, 2007 and a temperature sag followed reduction with an increase associated with generation output. A significant temperature increase was noted from data -  $\Delta 13$  °F or a move from 89.9 °F to 103 °F from 7:49pm to 8:28pm. The thirteen degree increase over a 39 minute period was the cause of the fish kill.

**January 24<sup>th</sup>, 2008** the Department's inspector, Durand Little, noted that all associated units and equipment were online. The IWTB and STP effluent was clear; however, Ash Basin No. 6 had slight gray tint, although recent TSS results looked good. Checked Oufall 001 condenser channel surface

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

temperature at confluence on west side, 17°C. The groundwater discharge at Outfall 006 was clear with an approximate flow of 1 gallon per minute.

**Table 2-10.** Outfall 002 Incidental Waste Treatment Basin

Flow	1.60	MGD		Chromium	0.050	mg/L
pH	7.58	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.129	mg/L
Temp	4.40	°C		Lead	0.001	mg/L
TSS	14	mg/L		Nickel	0.050	mg/L
Aluminum	0.223	mg/L		Mercury	0.001	mg/L
Arsenic	0.003	mg/L		Molybdenum	0.070	mg/L
Boron	0.200	mg/L		Selenium	0.007	mg/L
Cadmium	0.010	mg/L		Zinc	0.010	mg/L

**Table 2-11.** Outfall 003 Sewage Treatment Plant

Flow	0.014	MGD		NO <sub>2</sub> -N	0.01	mg/L
pH	7.33	S.U.		NO <sub>3</sub> -N	29.81	mg/L
D.O.	13.10	mg/L		TKN	1.00	mg/L
Temp	6.30	°C		NH <sub>3</sub> -N	0.16	mg/L
TSS	9	mg/L		TP	0.284	mg/L
TRC	1.40	mg/L		Fecal Coliform	20	CFU/100 mL
BOD <sub>5</sub>	2.20	mg/L				

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

**Table 2-12.** Outfall 004 Ash Basin No. 6

Flow	8.41	MGD		Chromium	0.050	mg/L
pH	7.46	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.288	mg/L
Temp	-	°C		Lead	0.001	mg/L
TSS	14	mg/L		Nickel	0.050	mg/L
Aluminum	0.286	mg/L		Mercury	0.001	mg/L
Arsenic	0.076	mg/L		Molybdenum	0.070	mg/L
Boron	0.200	mg/L		Selenium	0.007	mg/L
Cadmium	0.010	mg/L		Zinc	0.010	mg/L

**Table 2-13.** Outfall 006 Groundwater Discharge

Flow	-	MGD		Chromium	0.050	mg/L
pH	7.45	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.094	mg/L
Temp	-	°C		Lead	0.001	mg/L
TSS	2	mg/L		Nickel	0.050	mg/L
Aluminum	0.200	mg/L		Mercury	0.001	mg/L
Arsenic	0.003	mg/L		Molybdenum	0.070	mg/L
Boron	0.200	mg/L		Selenium	0.0155	mg/L
Cadmium	0.010	mg/L		Zinc	0.012	mg/L

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**May 4<sup>th</sup>, 2009** the Department's inspector, Joe Roth, noted that the FGD system was not yet online. The STP v-notch weir was in poor condition with corroded steel and solids lodged possibly distorting the readings. The oil booms at Outfall 002 in poor condition and need to be replaced as soon as possible.

**Table 2-14. Outfall 001 Non-Contact Cooling**

Flow	680	MGD		Temp	23.7	°C
pH	8.01	S.U.		TSS	12	mg/L
D.O.	-	mg/L				

**Table 2-15. Outfall 002 Incidental Waste Treatment Basin**

Flow	1.60	MGD		Temp	4.40	°C
pH	7.58	S.U.		TSS	12	mg/L
D.O.	-	mg/L		Oil & Grease	5	mg/L

**Table 2-16. Outfall 003 Sewage Treatment Plant**

Flow	0.015	MGD		NO <sub>2</sub> -N	0.01	mg/L
pH	8.19	S.U.		NO <sub>3</sub> -N	34.58	mg/L
D.O.	9.30	mg/L		TKN	1.04	mg/L
Temp	-	°C		NH <sub>3</sub> -N	0.04	mg/L
TSS	6	mg/L		TP	1.165	mg/L
TRC	0.00	mg/L		Fecal Coliform	-	CFU/100 mL
BOD <sub>5</sub>	3.50	mg/L				

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 2-17.** Outfall 004 Ash Basin No. 6

Flow	8.41	MGD		Cobalt	0.050	mg/L
pH	7.46	S.U.		Cooper	0.010	mg/L
D.O.	-	mg/L		Iron	0.193	mg/L
Temp	-	°C		Lead	0.001	mg/L
TSS	10	mg/L		Nickel	0.050	mg/L
Aluminum	0.225	mg/L		Magnesium	0.00662	mg/L
Antimony	0.002	mg/L		Manganese	0.017	
Arsenic	0.0033	mg/L		Mercury	0.002	mg/L
Barium	0.042	mg/L		Molybdenum	0.070	mg/L
Beryllium	0.001	mg/L		Potassium	0.00225	mg/L
Boron	0.200	mg/L		Silver	0.010	mg/L
Cadmium	0.010	mg/L		Sodium	0.0113	mg/L
Calcium	0.0302	mg/L		Thallium	0.002	mg/L
Chromium	0.050	mg/L		Vanadium	0.020	mg/L

**September 9<sup>th</sup>, 2009** the Department's inspector, Joe Roth, accompanied by Department staff, Shawn Arbaugh, Durand Little and Sean Furjanic inspected the IWTB, intake screening area and Ash Basin No. 6.

**January 6<sup>th</sup>, 2010** the Department's inspector, Joe Roth, accompanied by Jim Witman, P.E. and PPL representative, Deb Runkle, inspected new bottom ash pipe for Units No. 1 & No. 2 and the polishing pond discharge valve. The bottom ash line for Unit No. 3 was also inspected.

**March 22<sup>nd</sup>, 2010** the Department's inspector, Joe Roth, conducted a follow up to check status of new cooling tower start up with PPL Safety, Health and Environment manager, Rob Fultz. The intake flow was slowed in order to make fish uncomfortable and move them out of the cooling water discharge

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

channel and into the river. Observations at 10:05am confirmed that fish were still in the channel between the three unit discharge points and the cooling tower discharge point into the channel. Fish were observed to jump about every 1 to 5 minutes. Approximately 20 dead fish were observed in the river between Outfall 001 and a point about 75 yards downstream of which all appeared to have been recently killed. The channel temperature was 94°F and the cooling tower was off. Brown foam was observed in the discharge channel below the three unit discharge points. The chemicals used in the raw water are suspected to generate or cause the brown foam. An attachment showed the temperature from the previous 52 hours, with about a 20°F change in approximately 6 hours. During the morning of the inspection day, the temperature went from 95°F to 80°F and the river temperature was 50°F.

**March 29<sup>th</sup>, 2011** the Department's inspector, Joe Roth, met with PPL representatives John Talecki, Deb Runkle, Andrey Lerner and Tom Roth. The acid and caustic for the IWTB were checked and sediment is scheduled to be removed from this system in 2011. The STP control building, equalization tank and grinder pump was inspected. Inspection ended after the PPL Brunner Island data was discovered to be in disarray. Lists of equipment were not organized and some equipment descriptions were incorrect. A follow up would be conducted following the tax department organization of device list.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 3. Stream Flow

The United States Geologic Survey (USGS) maintains a stream gauging station on the Susquehanna River at Marietta, gauging station no. 01576000. This stream gauging station is the closest station downstream of the PPL BISES site at approximately 8.5 miles. The previous protection report used a  $Q_{7-10}$  flow of 3,283 cubic feet per second (cfs), which was reported by the Susquehanna River Basin Commission (SRBC) and the USGS for the period from 1972-2004.

The  $Q_{7-10}$  value closely matches the calculated  $Q_{7-10}$  value of 3200 cfs, obtained from the USGS Pennsylvania Stream Stats GIS application on September 14, 2011. The USGS PA Stream Stats  $Q_{7-10}$  value of 3200 cfs is an average value for the entire Susquehanna River up to the Marietta gauging station. Therefore, because the two values are consistent and the USGS PA Stream Stats value is up to date, the USGS PA Stream Stats  $Q_{7-10}$  is considered the most appropriate for the PPL BISES NPDES renewal. The USGS PA Stream Stats's watershed delineation tool, used at the PPL BISES site, produces a  $Q_{7-10}$  value of 3100 cfs with a drainage area of 25,500  $\text{mi}^2$ .

The  $Q_{7-10}$  of 3100 cfs produces a chronic or 30 day ( $Q_{30-10}$ ) and an acute or 1 day ( $Q_{1-10}$ ) exposure stream flows of (Guidance No. 391-2000-023):

$$Q_{30-10} = 1.36 * 3100 \text{ cfs} = 4216 \text{ cfs}$$

$$Q_{1-10} = 0.64 * 3100 \text{ cfs} = 1984 \text{ cfs}$$

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 4. Public Water Supply

The closest public water supply intake is owned and operated by the Wrightsville Borough Municipal Authority (WBMA) along the west shore of the Susquehanna River approximately 9.8 miles below the PPL BISES site (intake lat - 40°01'52.13", long - 76°31'47.9"). The WBMA uses two pumps to pump raw water from the Susquehanna River into Miller Quarry, which provides storage for the WBMA's WTP. The WBMA serves a total of 4076 consumers with water production ranging from 250,000 to 350,000 gpd. The WBMA WTP serves homes in Wrightsville, Hellam Township and several schools in Lower Windsor Township. Based on distance and dilution, the PPL BISES site is not expected to impact the public water supply for Wrightsville.

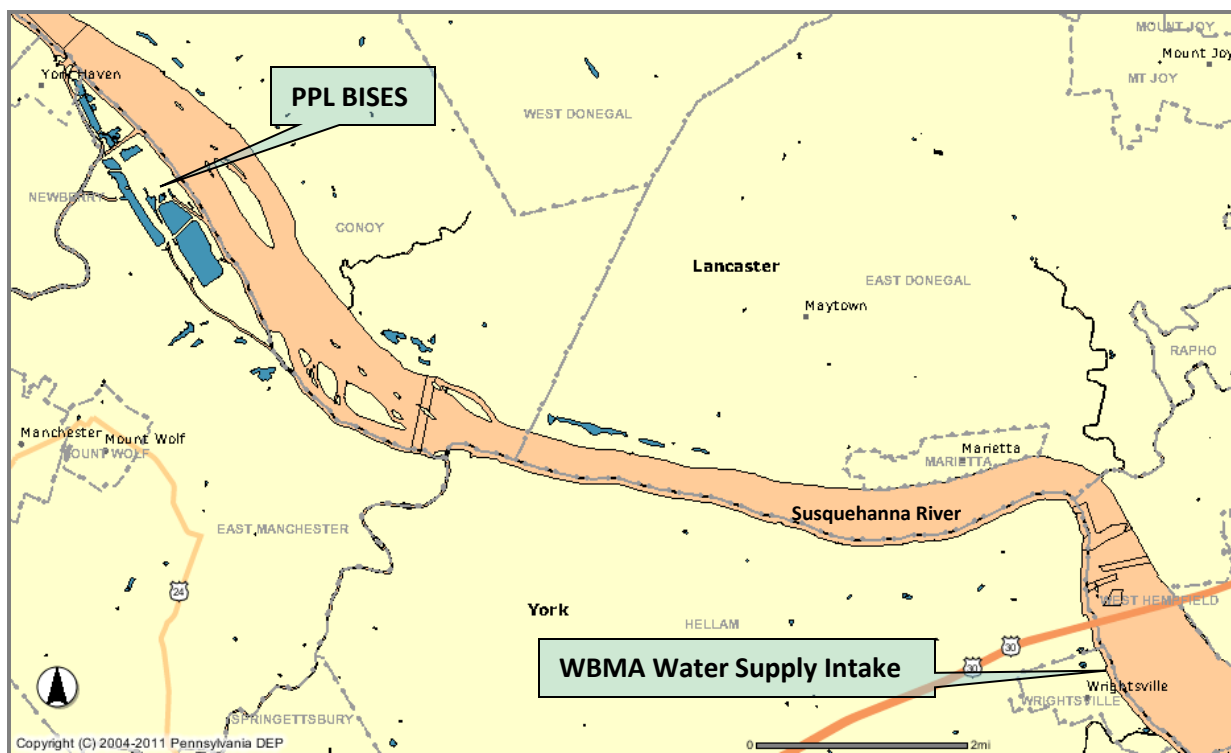


Figure 4-1. Location of the PPL Brunner Island site relative to the WBMA Water Supply Intake.



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 5. 316(b)

PPL Brunner Island has two cooling water intake structures (CWISs) subject to Clean Water Act Section 316(b) requirements. Section 316(b) requires that the “location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.”

The CWISs at PPL Brunner Island were included in the now suspended 316(b) Phase II rule which governed only power producing facilities with design intake flow (DIF) greater than or equal to 50 MGD. PPL performed a study to characterize impingement at the Brunner Island CWISs in order to determine how to meet impingement performance standards in the Phase II rule. The Phase II rule did not require PPL Brunner Island to meet entrainment performance standards because the DIF of the Brunner Island CWIS was less than 5% of the mean annual flow of the Susquehanna River. PPL also characterized the existing technologies and operational measures and evaluated other technologies to determine what would be the Best Technology Available (BTA) for the Brunner Island intakes.

The Phase II rule was remanded in 2007 and permitting authorities were directed to implement §316(b) using best professional judgment. As a result, the Department requested the information collected by Brunner Island under Phase II in order to make a BTA determination. PPL submitted the Best Technology Available Evaluation on July 2, 2008.

#### 5.1 Existing CWISs at Brunner Island

The CWISs at Brunner Island are situated along the shoreline and service Units 1, 2 and 3. The CWIS that services Units 1 and 2 has a DIF of 252,000 gpm (362.88 MGD) and the CWIS that services Unit 3 has a DIF of 552,000 gpm (794.88 MGD). Both CWISs are equipped with stationary vertical bar racks with one-inch spacing and traveling screens with 3/8 inch mesh. A screen spray wash system removes debris from the traveling screens; the debris is eventually disposed of off-site.

The CWIS associated with Units 1 and 2 has a calculated maximum approach velocity of 1.85 feet per second (fps) when all cooling water pumps are operating and through-screen velocity of 2 fps at minimum water elevation. The CWIS for Unit 3 has a calculated maximum approach velocity of 2.2 fps, when all cooling water pumps are operating and a through-screen velocity of 2.3 fps at minimum water elevation.

A debris wall is being constructed upstream of the Brunner Island CWISs to reduce debris at the intakes. The debris wall will alter river current in front of the CWISs and potentially affect impingement and entrainment at the CWISs.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 5.2 Impingement Characterization Study

Impingement monitoring was conducted from May 2005 through April 2006 and consisted of 39 sampling events. Forty species of fish were present in impingement collections, although some species were much more abundant than others. Gizzard shad comprised of more than 94% of impingement collections (53,317 gizzard shad collected of total 56,612 impinged fish). Smallmouth bass were also frequently impinged (2,059 total). It is noted in the evaluation that there was wide variability in impingement collections, even when collections occurred in roughly the same time period (seasonally).

The actual impingement sampling numbers were extrapolated to determine a calculation baseline (as required under Phase II rule) and actual annual impingement occurring based on current conditions. PPL estimated 490, 258 fish as the annual calculation baseline and 399,491 as an actual annual impingement estimate. PPL estimated an 18.5% reduction from the calculation baseline due to operating less than capacity and withdrawing cooling water at less than the design intake flow.

#### 5.2.1 Technologies Evaluated and Suitability

PPL evaluated the following technologies for implementation at Brunner Island: course-mesh modified traveling screens (Ristroph) with a fish return; coarse mesh wedgewire screens; Geiger multi-disc screens; diversion technologies such as acoustic deterrents, strobe lights, and louvers; and variable frequency drives. Closed-cycle recirculating cooling was not evaluated since PPL recently installed a large array of mechanical draft (helper) cooling towers and believed it was “redundant” to consider closed-cycle cooling.

PPL characterized all of the technologies evaluated as unsuitable for the Brunner Island intakes. Wedgewire screens were predicted to reduce impingement mortality by 100%, but hydraulic modeling must be done once the debris wall is installed to determine if the resulting ambient river currents will preclude feasibility of this technology. Diversion devices, such as acoustic deterrents and strobe lights were determined to be effective for only a few of the fish species and therefore not suitable (by themselves) to reduce impingement mortality. PPL determined that variable frequency drives would not provide any significant impingement mortality reduction and resulting flow reductions would result in additional heat loading in the effluent. PPL stated that overall suitability of either the modified screens with fish return or Geiger screens remains uncertain without conducting pilot studies to determine if either technology will meet impingement BTA standards.

PPL projects that coarse mesh modified screens with a fish return would reduce impingement mortality, but survival varies among species of fish. PPL estimates that impingement mortality would be reduced by only 17%. Since gizzard shad comprise most of the impingement and studies that PPL

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

referenced show that gizzard shad do not survive well after being impinged (even when they are returned to the river), the survival estimate of all fish is only 17% (83% mortality). PPL conservatively assumed that modified screens would reduce impingement mortality of gizzard shad by only 12.5% based on certain studies (Black 2006, EPRI 1999, PSEG 1998, PSEG 2002, PSEG 2004) which studied latent mortality for 96 hours post impingement. However, an Electric Power Research Institute 2006 report "Technical Resource Document for Modified Ristroph Traveling Screens" determined that modified Ristroph screens may reduce gizzard shad impingement mortality by as much as 86%. It should be noted that EPRI 2006 used data from impingement studies that assessed latent mortality for 24 hours or longer.

Regardless of gizzard shad mortality, the total impingement mortality of all other species besides gizzard shad may be reduced to 80-90% with the use of modified screens and fish return.

PPL attempted to assess the potential impingement mortality reduction resulting from the use of Geiger multi-disc screens, but information for many of species is not available. Overall survival rates ranged from 43% - 97% where data was available.

### 5.3 Proposed Existing Facilities Rule

The Section 316(b) Existing Facilities rule was proposed on April 20, 2011. The rule is expected to be final by July 27, 2012. If the final rule reflects the proposed provisions, PPL Brunner Island would be required to meet BTA standards for impingement mortality and entrainment.

Proposed impingement standards include either reducing maximum intake velocity to 0.5 fps or achieving impingement mortality limitations of 30% on a monthly average basis and 12% on an annual average basis. EPA based the limitations on what could be achieved by modified screens and fish return systems.

Proposed entrainment standards are established on a case-by-case basis by the permitting authority. The proposed rule requires CWISs that withdraw greater than 125 MGD (actual intake flow) submit an entrainment characterization study, including peer review; a comprehensive technical feasibility and cost evaluation study; a benefits evaluation study; and a non-water Quality and other environmental impacts study. The proposed definition of entrainment states that entrained organisms include those that could pass through a 3/8 inch sieve. Organisms that are retained in a 3/8 inch sieve are considered to be impinged.

Entrainment reduction can be achieved primarily by reducing the intake flow. Screens with mesh size no greater than 2 mm (along with a return system) may also be able to minimize entrainment. Closed-cycle recirculating cooling can reduce the intake flow by 90% or more and achieve a 90% or

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

greater reduction in entrainment mortality. A combination of technologies and operational measures may also achieve similar entrainment reductions such as: water reuse; partial recirculating of cooling water; variable speed drives/pumps; seasonal flow reductions or other operational or process changes including seasonal shutdowns during biologically sensitive times; or screens with 2mm mesh and a fish return.

The proposed rule requires that impingement standards be met no later than 8 years after the rule is final. The compliance schedule for meeting entrainment standards is determined by the permitting authority; however there is a schedule for submitting application information concerning entrainment in the proposed rule.

It is recommended that following completion of the 316(b) rule, that the PPL Brunner Island permit be amended to reflect the requirements of the final rule.

### **6. Outfall 001 Non-Contact Cooling Water**

Outfall 001, located along the condenser discharge channel, receives 795 million gallons per day (MGD) of once-through non-contact cooling water. The condenser channel is approximately 2,000 feet long with the cooling water discharge point situated approximately at the halfway point of the channel.

Once through non-contact cooling water enters the condenser discharge channel and at approximately half way down the channel is pumped by three vertical column, single stage intake pumps, each with the ability to pump 200 MGD or 138,888 gpm. A fourth pump is present as a backup. The once through non-contacting cooling water is pumped into a 34 cell (two rows of 17 cells) mechanical draft counter flow cooling tower. The heated water is sprayed through nozzles as air is pulled upward by the two speed fans. As the water exits the tower structure it flows down a concrete cascade and back into the condenser channel. Across from the cascade, the shoreline has been lined with riprap to prevent erosion. The cooling tower basin, which collects the cooled water, is approximately 920'L X 102'W X 3'D. The cooling tower structure is located on the eastern end of a retired ash basin known as Ash Basin No. 4.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 6.1 Thermal Discharge History & 316(a) Variance

PPL Brunner Island has operated under a 316(a) variance based on a study conducted by PPL in the 1970s. The Department and EPA subsequently reviewed this study in 1977 and gave conditional acceptance with alternate thermal limits granted in 1981. These limits were included in all subsequent permit renewals; however, the NPDES renewal in 2002 required PPL to conduct biological monitoring studies to determine whether the once through cooling water was causing “appreciable harm” to the indigenous aquatic communities within the Susquehanna River. The biological surveys were conducted from 2002 through 2005. The same 2002 NPDES permit required PPL to monitor hourly temperature changes downstream of their discharge. The temperature monitoring was completed in 2003. The biological and temperature data collected during this period showed that the once through cooling water elevated the river temperature above the Department’s Chapter 93 criteria for warm water fisheries (WWF). The Department biologist reviewed the data and found there to be appreciable harm to the aquatic communities up to 3 miles downstream of outfall 001 along the western shore of the Susquehanna River near the confluence with Codorus Creek.

Additionally, the Department’s engineer, who reviewed the NPDES renewal, conducted helicopter flyovers of the Susquehanna River with the Pennsylvania State Police in June of 2004 and September of 2005. The infrared images taken from that flyover confirmed a thermal plume along the western shore of the Susquehanna River down to the confluence with the Codorus Creek.

The Department and PPL Brunner Island, LLC entered into consent order and agreement (COA) on March 27, 2006. This required PPL BISES to construct a cooling system capable of removing 55% of the total heat load during the worst-case summertime humidity conditions at a 16°F approach temperature or the temperature of the wet bulb or dew point temperature plus 16°F. Also, the COA required that PPL’s once through cooling water could not change the receiving stream by 2°F during any one-hour period and that 100% of the plant condenser cooling water was effectively cooled.

The Department agreed to allow a 5,000 ft mixing zone based on the flyover infrared images, PPL’s dynamic model for estimation of mixing and Department biologist determination that critical habitat exist immediately below the 5,000 ft mixing zone. The Department determined heat rejection rates that provided a 4°F increase above the WWF criteria during April, 2°F increase above the WWF criteria during March and May through November and an 8°F increase above WWF criteria during the winter months. These limits were determined to be consistent with the 316(a) variance providing a year round variance to meeting state water quality standards. The Department granted PPL BISES the ability to turn the cooling towers off from December 1<sup>st</sup> through February 29<sup>th</sup> based on the cost to run the towers, concerns over freezing within the towers and because the discharge was not

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

suspected of causing biological harm in the winter. The Department biologist agreed to the winter condition; however, further biological surveys were required to confirm or reject these assumptions.

PPL Brunner Island, LLC submitted a water quality management (WQM) permit on May 29<sup>th</sup>, 2007 for the construction of a 34 cell mechanical draft counter flow cooling tower. The Department approved the WQM permit, no. 6707201, on November 29<sup>th</sup>, 2007. PPL completed construction of the cooling towers on March 31, 2010 and began operation on April 1<sup>st</sup>, 2010.

The current NPDES required PPL Brunner Island, LLC to conduct biological assessments of the Susquehanna River below the cooling tower discharge to confirm or reject the calculated heat rejection rates. The biological assessments required summer (defined as August) and winter (defined as December 1<sup>st</sup> through February 29<sup>th</sup>) assessments for the remainder of the permit following startup of the cooling towers.

### 6.2 Once Through Cooling Water Flow Data

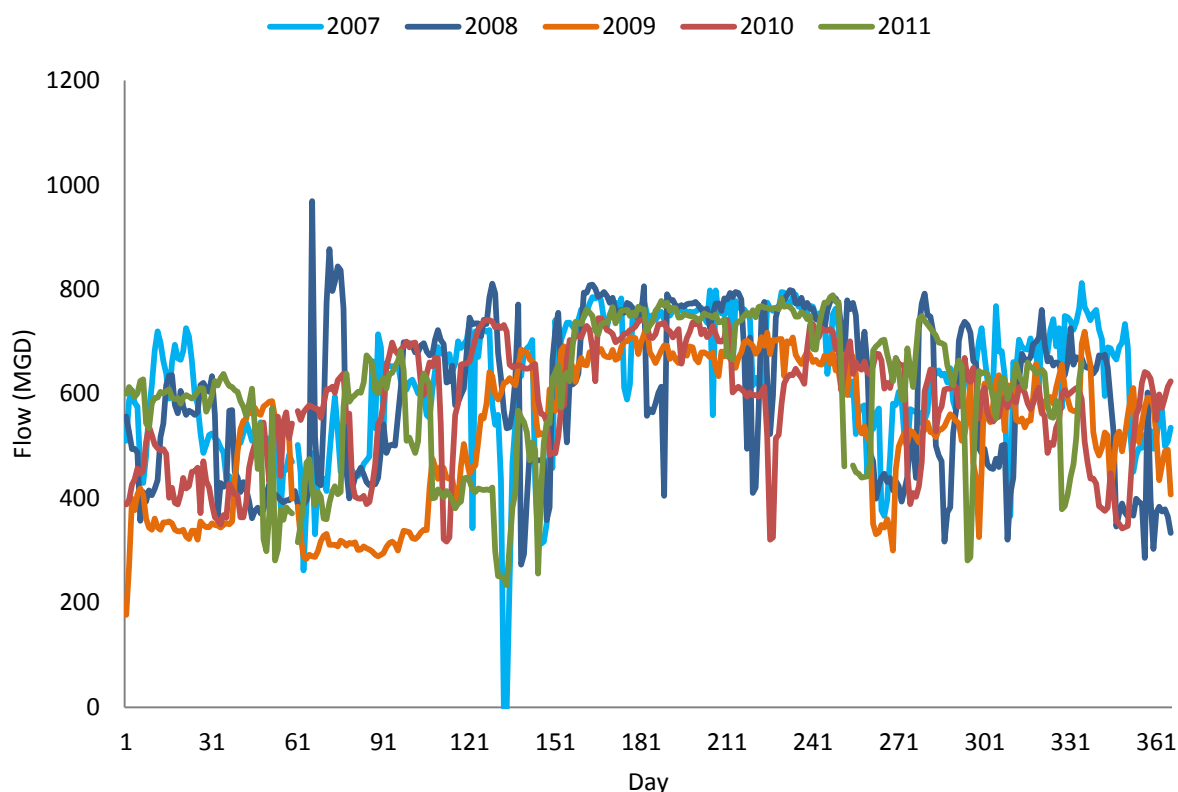
PPL Brunner Island, LLC is permitted to discharge an annual average flow of 795 MGD through outfall 001. The discharge rate data generally trends up in the warmer months and down in the cooler months. Therefore PPL's discharge rate is typically highest when the Susquehanna River is most likely to experience Q<sub>7-10</sub> flow conditions. The graph below shows PPL Brunner island's discharge rates from January 1<sup>st</sup>, 2007 through November 30<sup>th</sup>, 2011. On May 12<sup>th</sup> and 13<sup>th</sup> of 2007, all units were taken out of service, this explain the zero flows shown in the graph below. Additionally, the high discharge rates shown between the 60 and 90 day mark in 2008, resulted from flooding that occurred on the Susquehanna River between March 6<sup>th</sup> and March 17<sup>th</sup>, which interfered with the flow metering.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

**Figure 6-1. Outfall 001 Flow (MGD) Jan 2007 – Nov 2011**



The table below provides basic statistical parameters for the PPL Brunner Island discharge rate. The red bars indicate the highest value in each statistical parameter.

Table 6-1. Discharge Rate (MGD) Statistical Summary						
	2007	2008	2009	2010	2011*	Trend
Mean	622.1	597.6	528.1	585.4	601.2	
Median	639.0	622.5	550.0	606.0	623.5	
Mode	765.0	773.0	340.0	614.0	749.0	
Standard Deviation	128.5	151.5	137.3	113.4	137.3	
Minimum	0.0	273.0	177.0	317.0	234.0	
Maximum	812.0	969.0	731.0	745.0	789.0	

\*Represents available data from January through November.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 6.2.1 Cooling Tower Temperature Requirements

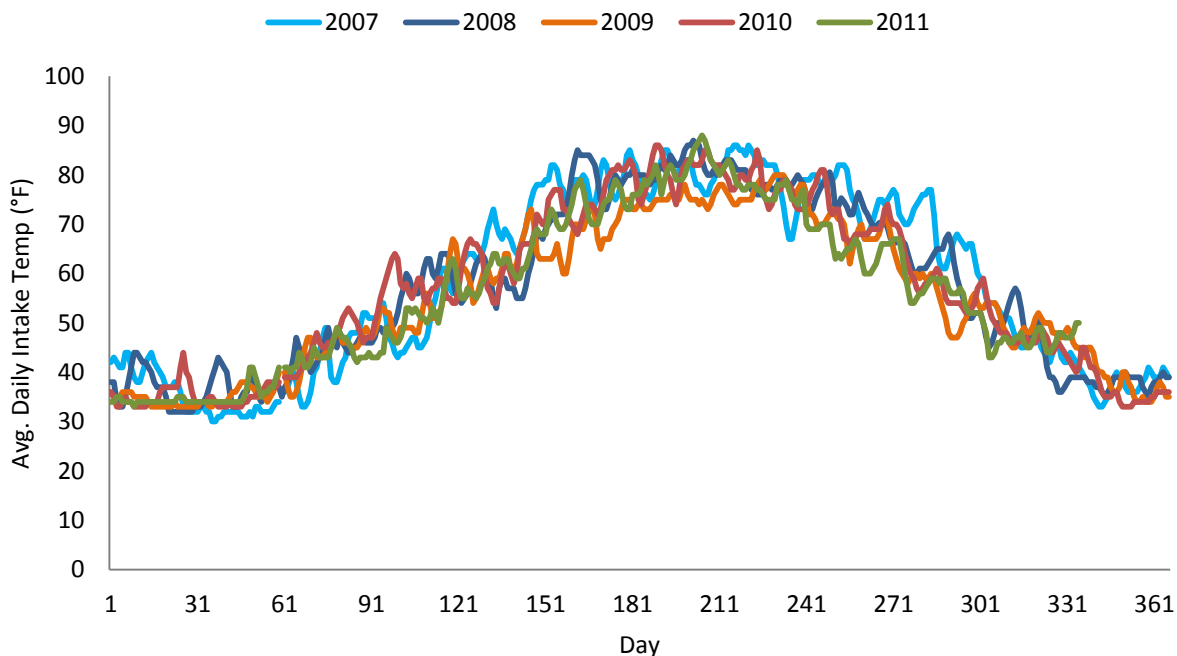
PPL Brunner Island, LLC operates the mechanical draft cooling towers from March 1<sup>st</sup> to November 30<sup>th</sup> per their NPDES permit. They are required to meet heat rejection rates as previously determined through the use of the Department's temperature guidance and Excel spreadsheet calculator. The heat rejection rates are reported as maximum daily rates. These rates indicate the amount of heated mass that the Susquehanna River can accept and not the amount of heat that the cooling towers must remove from the non-contact cooling water. The table below shows the heat rejection rates that PPL Brunner Island is required to meet each month.

Table 6-2. Heat Rejection Rates (MBTUs/Day)												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
MBTUs/day	167,040		91,870		83,520		75,170			83,520	91,870	167,040

### 6.2.2 Power Plant Intake & Outfall Temperature

PPL Brunner Island, per their NPDES permit, has recorded the intake temperature for the power plant (Please Figure 3).

Figure 6-2. Average Daily Plant Intake Temp (°F) Jan 2007 – Nov 2011





## **Water Quality Protection Report**

PPL Brunner Island, LLC

PA0008281

---

The plant intake temperature data generally appears to follow a normal distribution, which confirms that the Susquehanna River, a wide and relatively shallow river, experiences warmer water temperatures in the summer months and cooler temperatures in late fall, winter and early spring.

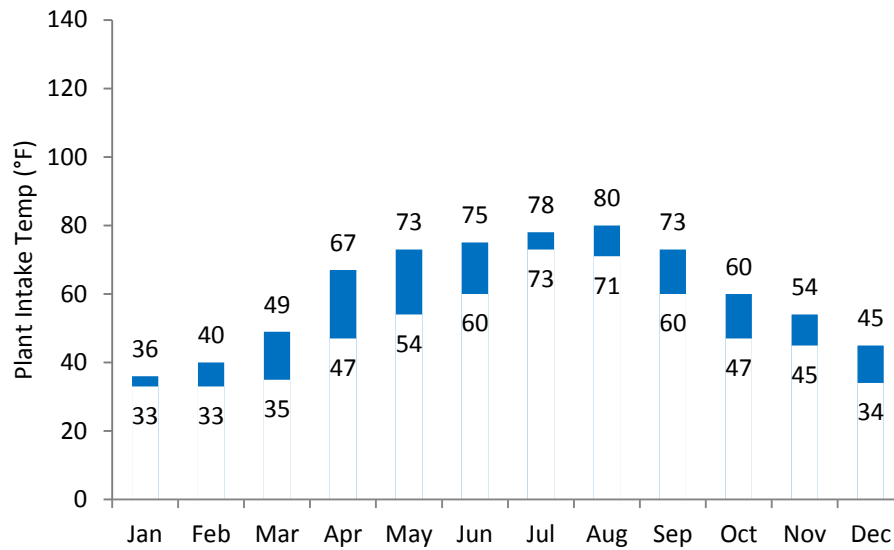
The data provided on the subsequent pages, show a comparison of the minimum and maximum intake temperature versus the minimum and maximum cooling tower (CT) effluent temperature for 2009 and 2010. The CT effluent data used in the comparison does not reflect the data collected at the 5,000 ft downstream compliance point. The 2009 effluent data set reflects pre-cooling tower discharge. The 2010 data set shows post-cooling tower effluent (cooling towers went into operation April of 2010).

## Water Quality Protection Report

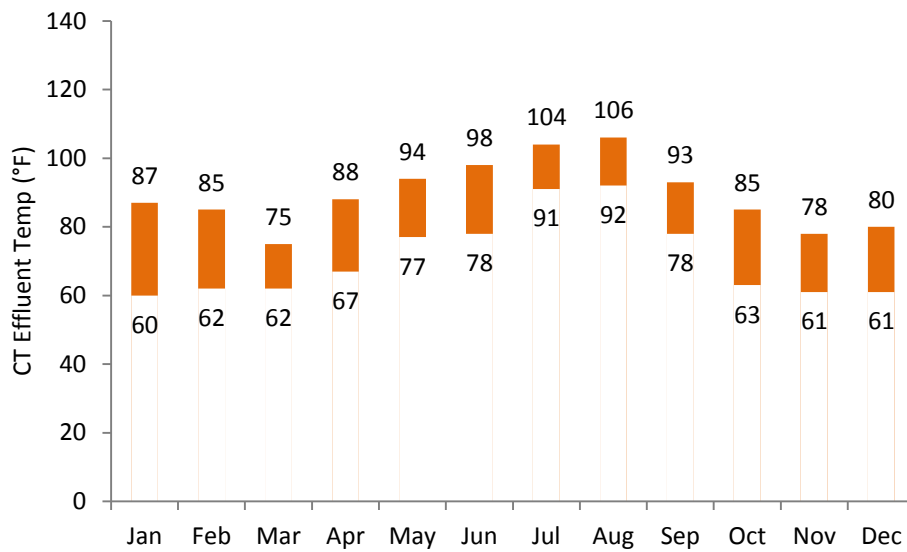
PPL Brunner Island, LLC

PA0008281

**Figure 6-3. 2009 Monthly Min & Max Plant Intake Temp (°F)**



**Figure 6-4. 2009 Monthly Outfall 001 Effluent Min & Max Temp (°F)**

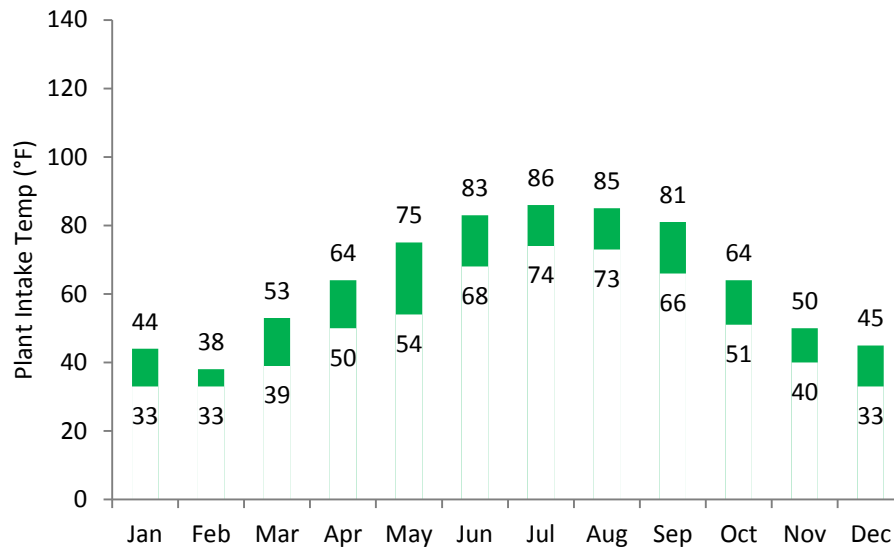


## Water Quality Protection Report

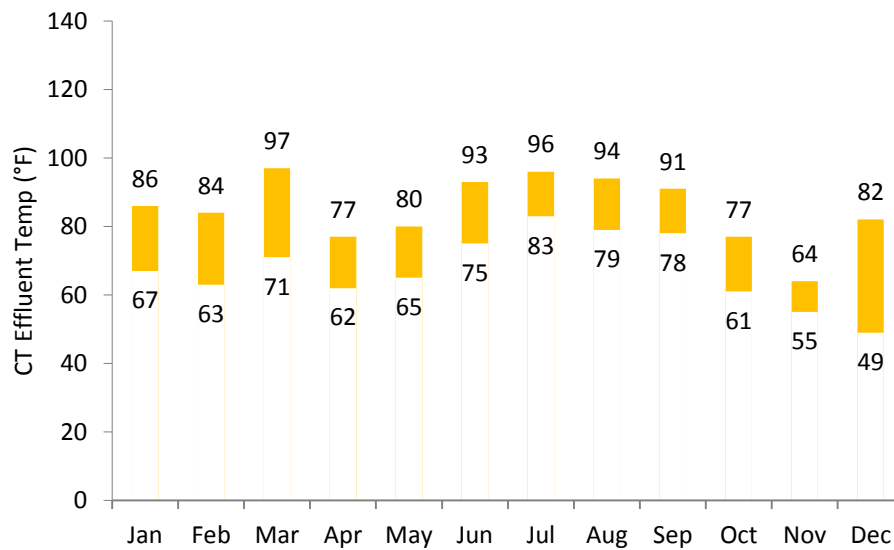
PPL Brunner Island, LLC

PA0008281

**Figure 6-5. 2010 Monthly Min & Max Plant Intake Temp (°F)**



**Figure 6-6. 2010 Outfall 001 Effluent Min & Max Temp (°F)**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The 2009 min and max data show that the effluent without cooling is substantially higher in the warm season months. The plant intake temperature data shows a maximum temperature of 78°F in July, 80°F in August and 73°F in September. The intake temperature data compared to the effluent temperature data from outfall 001, prior to cooling tower operation, shows a maximum temperature discharge of 104°F in July, 106°F in August and 93°F in September. Typically, July, August and September are the months that the Susquehanna River is most likely to experience Q<sub>7-10</sub> conditions and therefore a large thermal discharge could overwhelm the aquatic community within the river. The 2009 maximum discharge temperatures (pre-cooling) of 104°F and 106°F in July and August, begins to approach the Department's 110°F public safety value found in the Department's temperature guidance (doc. no. 391-2000-017 *Implementation Guidance for Temperature Criteria*, April 11, 2009). Based on the maximum discharge temperature for 2010, July and August, the CT effluent is maintained well below the public safety value.

Additionally, the data for the winter months of December, January and February, in 2009 and 2010, show large temperature disparities between the intake and effluent data. For example, the data in January of 2009 shows a maximum temperature difference of 51°F and for January of 2010 the data is similar with a difference of 42°F. However, the Susquehanna River during the cold season months does flow well above the Q<sub>7-10</sub> conditions; therefore, the assumption is that the thermal mass from the discharge will have a negligible effect on the aquatic community because as a percentage of river flow, the discharge is much less. Over a ten year period, 2001 through 2011, the USGS gauging station data for the Susquehanna River, for the month of January, shows a median flow range of 13,421 cfs to 83,877 cfs. The median discharge rate from PPL Brunner Island for January, over the period from 2007 through 2011, shows a range of 535 cfs to 928 cfs. The current NPDES permit requires PPL Brunner Island to perform several winter biological field studies to verify the validity of this assumption.

Also, mechanical draft counter flow cooling towers are subject to icing during the cold season months and this was an initial concern of PPL Brunner Island. However, the SPX Cooling Technologies, Inc.'s 2<sup>nd</sup> Edition of *Cooling Tower Fundamentals* (Edited by John C. Hensley, 2009. SPX Cooling Technologies, Inc., Overland Park, Kansas) does offer some potential operating guidelines for the prevention and reduction of ice formations on cooling towers of all types. In the event that the biological data does not confirm the winter discharge assumption, PPL Brunner Island should prepare standard operating procedures for cooling tower operations in cold season months and the Department should determine heat rejection rates for the winter months.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 6.3 In-stream Temperature Monitoring

The current NPDES permit requires PPL Brunner Island to monitor temperature at eight locations through the Susquehanna River. Locations M1, located on the west shore of the river, and M2, located on the east shore of the river, are both situated above the discharge channel at Brunner Island. Locations M3 through M8 are oriented from the west shore to the east shore at the 5,000 ft compliance point. The NPDES permit requires that PPL Brunner Island continuously monitor the ambient river temperature. For compliance purposes, PPL Brunner Island is allowed to average the temperature data measured across the transect formed from M3 through M8. At the 5,000 ft compliance point, low flow conditions in the river allow the thermal plume to extend across the Susquehanna River to the east shore (location of M8). However, during higher flows, the thermal plume tends to stay along the west shore of the river. In the event the biological data does not support current calculations, previous observations and assumptions used to develop the current 316(a) variance, it is recommended that ability to average the thermal monitors M3 through M8 be removed from the permit if PPL Brunner Island is allowed compliance at the 5,000 ft downstream location. Since M3 and M4 appear to be in the direct zone of influence of the thermal discharge, these two temperature monitoring locations could be averaged. By allowing the averaging of M3 and M4, PPL Brunner Island could better adjust their cooling tower performance to meet compliance at the current 5,000 ft compliance point and reduce any potential biological harm between the cooling towers and the compliance point.

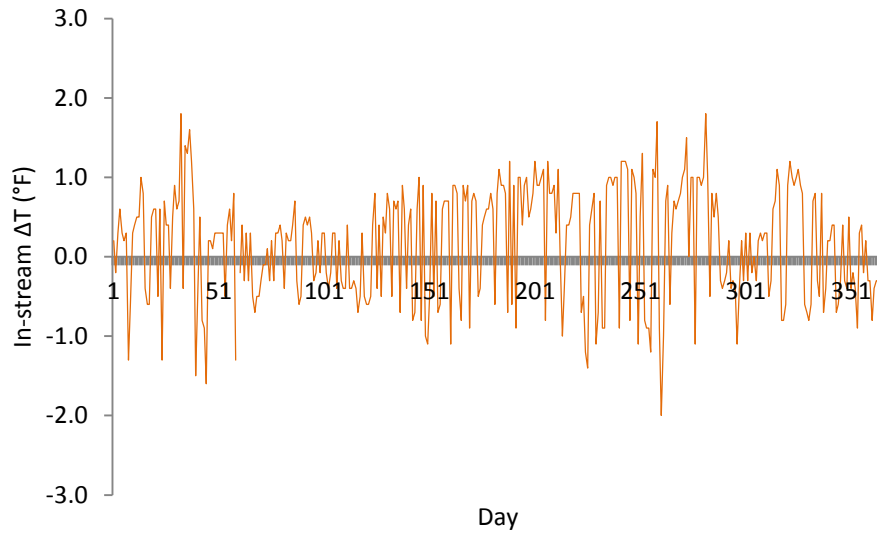
The selected data below represents the 2009 and 2010 in-stream temperature data. Similar to the previous section, 2009 represents pre-cooling tower data and 2010 represents post-cooling tower data. The data shows the change from the ambient river water temperature; therefore, depending upon the time of year, the zero value can represent different ambient temperatures. As previously stated, the towers operate from March 1 through November 30.

# Water Quality Protection Report

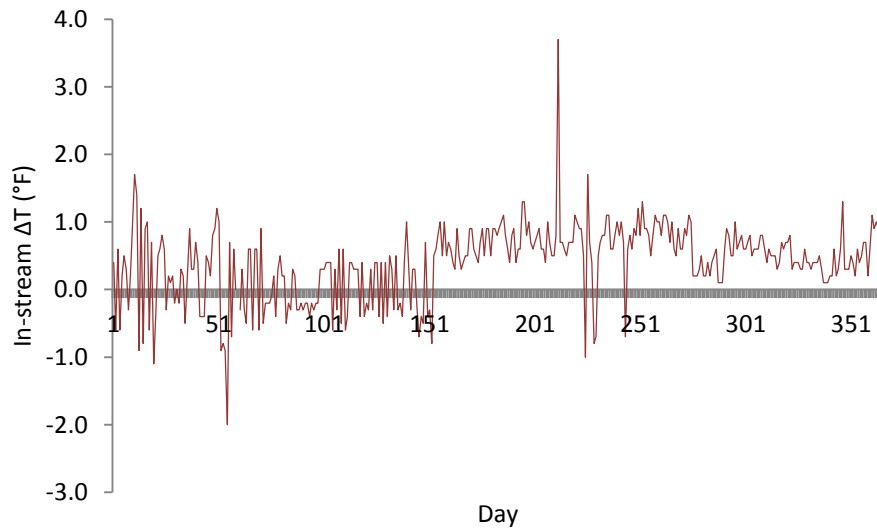
PPL Brunner Island, LLC

PA0008281

**Figure 6-7. 2009 In-stream  $\Delta T$  (°F)**



**Figure 6-8. 2010 In-stream  $\Delta T$  (°F)**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 6.3 .1 Biological Data

PPL Brunner Island is required by their current NPDES permit to perform biological studies post cooling tower construction at a minimum of one study per the summer time and one study per the winter time per the remainder of the NPDES permit cycle. The Part C condition states the following:

“The Department has approved a variance from meeting state water quality standards to the permittee under Section 316(a) of the Clean Water Act under the assumption that the Final Heat Rejection Rate limitations for Outfall 001 will result in a balanced, indigenous aquatic life community in and on the body of water at a distance of 5,000 feet downstream of the discharge channel. To verify this assumption, the permittee shall conduct biological monitoring studies, at a minimum, each summer (August) and winter (December 15-February 28) following startup of the cooling structures required in Part C III, for the remainder of the permit term. The studies shall be completed in accordance with the approved Biological Monitoring Study Plan. The Department will evaluate all data submitted by the permittee.”

Subsequently, PPL Brunner Island submitted two winter studies (a pre and post tower survey) and a summer study.

The Department biologist reviewed the post-cooling tower surveys for both the summer and winter and found the following:

- The pre-cooling tower winter of 2010 survey (Pre-tower Survey 4) is largely incomplete in terms of data because of Susquehanna River flows that were considered dangerously high.
- The summer survey reported high numbers of mosquitofish (*Gambusia sp.*) collected from impacted stations along the west shore of the Susquehanna River or within the zone of influence of the thermal plume (plume tends to stay closer to the western shore). The species is considered non-native to the Susquehanna River and are far more tolerant of high water temperatures and low dissolved oxygen environments than the other fish species collected. Since no mosquitofish were collected at any of the reference station, but hundreds were collected at the impacted stations, the data suggest that the thermal discharge is impacting the resident summer fish community during tower operation periods. The Department biologist further noted that on page 8 of the summer survey report, the author states “Excluding the presence [sic] mosquitofish, all stations exhibited generally similar metrics.” The Department biologist note that if the warm water discharge impacts are excluded, there would be no mosquitofish present at the impacted stations and all stations would exhibit similar metrics.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- The post-cooling tower winter survey for 2011 is incomplete because PPL Brunner Island's consulting biologist from Normandeau were unable to sample and collect data due to dangerously high river flows. This study lacks electro-fishing and HesterDendy data.

The Department biologist remark that the benthic macroinvertebrate (BMI) data does show improved conditions between surveys; however, additional BMI sampling is recommended. Therefore, because of the limited data from winter and summer surveys, it is recommended that PPL Brunner Island continue biological monitoring based on the previously agreed to biological study requirements for three years' worth of sample data.

### 6.4 Recommended Limits

The current heat rejection and temperature data from the Brunner Island cooling towers are within the permitted limits; however, the biological data at this time is incomplete. At this time it is recommended that PPL Brunner Island continue to operate under the current 316(a) variance. Once the additional biological field studies becomes available, and in the event that the data shows appreciable harm to the aquatic community, it is recommended that the permit be re-opened to adjust the current 316(a) variance for the thermal rejection rates, 5,000 ft compliance point and the partial year CT operation period.

PPL Brunner Island, LLC has requested that the current NPDES permit requirement regarding the 2°F hourly in-stream temperature change be modified to allow an 8°F hourly in-stream temperature change. The Department's 2°F in-stream hourly change is meant to protect against both cold shocks, the result of a power plants sudden shutdown, and to limit the excursions above allowable temperature limits (see PA DEP's guidance doc. no. 391-2000-017 *Implementation Guidance for Temperature Criteria*, April 11, 2009).

The 25 Pa Code § 93.7 states the following regarding temperature:

"Maximum temperature in the receiving water body resulting from heated waste sources regulated under Chapters 92, 96 and other sources where temperature limits are necessary to protect designated and existing uses. Additionally, these wastes may not result in a change by more than 2°F during a 1-hour period"

In the current NPDES permit, under Part A Footnote 7, the permittee was allowed the following:

"The permittee shall conduct a laboratory study to determine a site-specific hourly temperature change criterion under 25 Pa. Code Chapter 93.8(a) as an alternative to the criterion in 25 Pa. Code Chapters 96.6(b) and 93.7. The study shall be completed and a Final Report shall be submitted to the Department by



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

May 31, 2009. Two copies of the Final Report shall be submitted to the Department's Southcentral Regional Office, and two copies of the Report shall be submitted to the Department's Central Office, Bureaus of Water Standards and Facility Regulation. The Department may reopen and amend this permit based on the results of the site specific study."

The Department has reviewed the results of the study commissioned by PPL Brunner Island, LLC and conducted by the Stroud Water Research Center. The Department's review found the following limitation to the study:

- The study "Evaluating the Seasonal Effects of Short-Term Temperature Fluctuations on Macroinvertebrates and Fish in the Susquehanna River near the Brunner Island Steam Electric Station" was specifically designed to evaluate sub-lethal effects in aquatic organisms resulting from varying rates of temperature change. In order to evaluate sub-lethal effects only, temperature extremes that might cause mortality were avoided in the experiments' test conditions. For example, the design temperature conditions in the warm season experiments ranged from 68°F to 82°F; these conditions are generally in the mid-range of the specimens' thermal tolerance and do not approach stressful thermal thresholds. The rate of change of temperature may be more stressful to organisms as thermal thresholds are approached. Since temperatures in the Susquehanna River naturally rise above 82°F, the results of the study are insufficient to ensure that 8°F/hour is adequately protective of the aquatic organisms near the Brunner Island Steam Electric Station.

The Department worked with the Stroud Water Research Center on the continuation of the PPL Brunner Island study to address the limitations; however, the data is currently under review. Additionally, the Department is re-evaluating scientific literature and data to assess the effectiveness of the 2°F in-stream hourly change. It is recommended that the permit be reopened in the event that the Department revises this Chapter 93 requirement. However, the 2°F in-stream hourly change limitation should remain in the permit with the 5,000 ft compliance point. If through additional data collection and studies, a site specific criterion is devised for in-stream hourly temperature change for PPL Brunner Island, then the 5,000 ft compliance point should be removed from the permit because the site specific criterion should be capable of protecting the aquatic community at the confluence of the discharge channel and Susquehanna River.

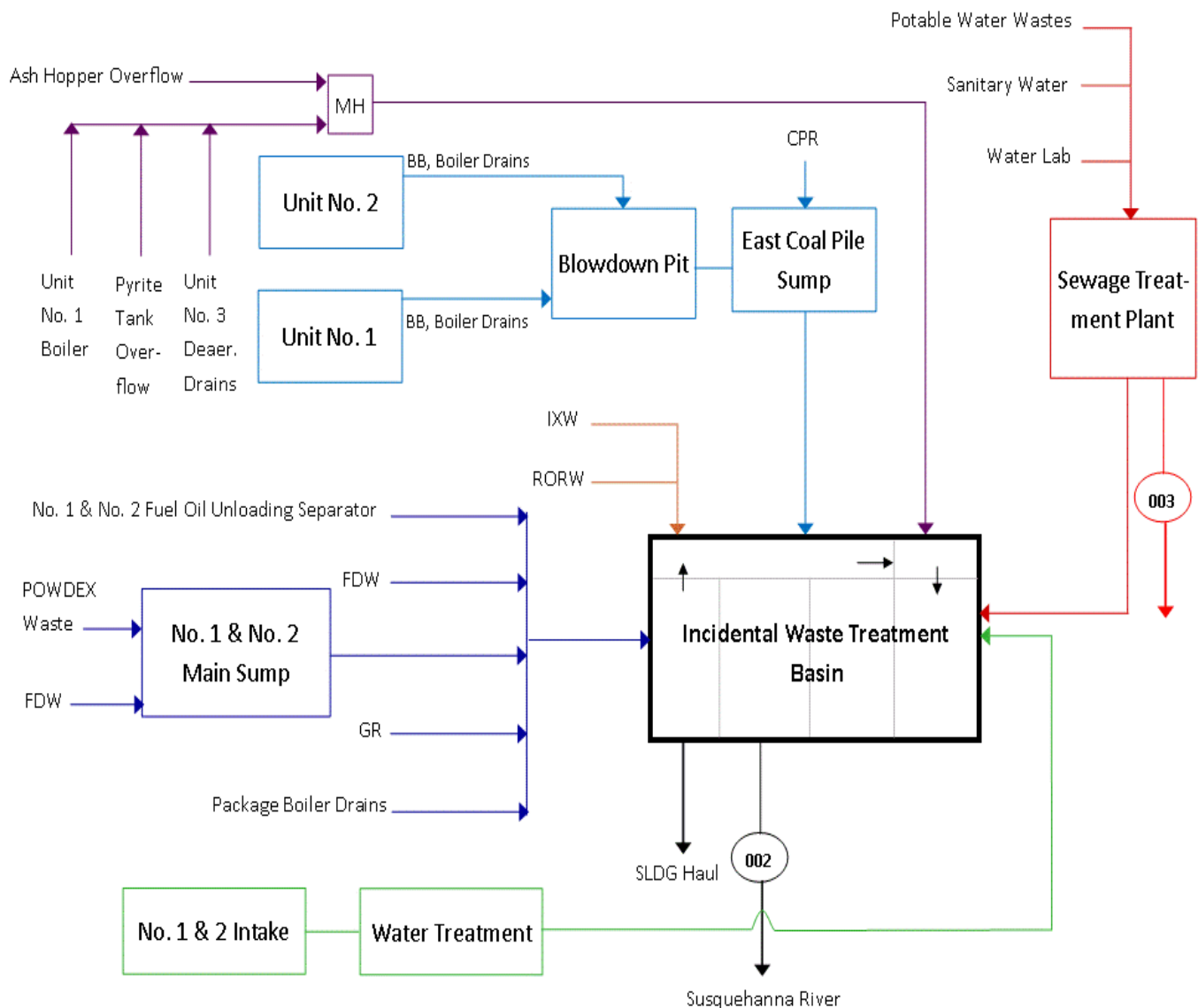
## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 7. Outfall 002-Incidental Waste Treatment Basin (IWTB)

The IWTB receives wastewater and storm water from several sources within the PPL BISES site. Based on the PPL BISES NPDES renewal application, dated March 18, 2011, the long term average discharge rate is 2.0 MGD with a maximum daily discharge rate of 6.0 MGD. **Figure 7-1. Wastewater flows from the various system processes to the IWTB.**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 7-1. Schematic Abbreviations IWTB**

CPR	Coal Pile Runoff		POWDEX Waste	Boiler Water Treatment System abbr.
IXW	Ion Exchange Water		RORW	Reverse Osmosis Reject Water
FDW	Floor Drain Water		MH	Manhole

### 7.1 IWTB Operations

Wastewater and stormwater entering the IWTB is treated as follows:

pH Neutralization → Sedimentation → Oil Skimming → Discharge to 002

Influent entering the IWTB is monitored for pH, which is automatically adjusted with sulfuric acid, sodium carbonate or sodium hydroxide to maintain the pH level between 6.5 and 8.5 S.U. The wastewater enters a control station, which includes the pH probe, prior to entering the first of three treatment cells. Aluminum sulfate is used to aid the precipitation/sedimentation process. The effluent is monitored and adjusted for pH; however, recirculation pumps are automatically activated to recycle the effluent if the pH does not fall within the maintained range of 6.5 – 8.5 S.U. The IWTB also uses oil booms to control the oil and grease levels in the final effluent. The solids removed from the IWTB are placed in Ash Basin No. 6.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 7.2 Existing Limits

The current NPDES permit, permit cycle October 1<sup>st</sup>, 2006 to September 30, 2011, requires the following parameters be sampled for (**Table 7-2 Existing Outfall 002 Discharge Limits**):

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	2/month	Grab
TSS	XXX	XXX	M&R	XXX	50	2/month	Grab
Total Aluminum	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Arsenic	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Boron	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Cadmium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Chromium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Copper	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Iron	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Lead	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Mercury	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Molybdenum	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Nickel	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Selenium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Zinc	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

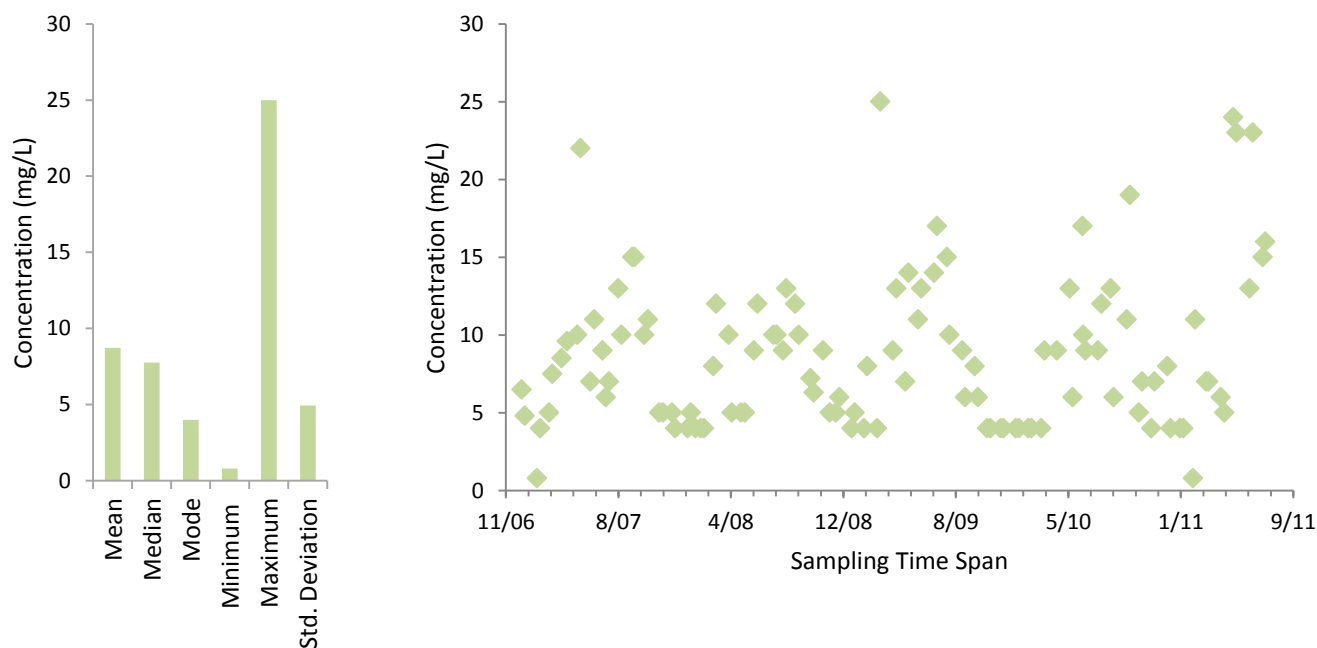
### 7.3 pH

The effluent discharge pH is required to remain above 6 and below 9 standard units (S.U.) according to 25 Pa Code § 95.2(1)(i).

### 7.4 Total Suspended Solids (TSS)

The grab sample results for the daily maximum TSS concentrations from the effluent at outfall 002 have remained below the permitted instantaneous maximum value of 50.0 mg/L.

**Figure 7-2. Outfall 002 TSS Concentration Descriptive Statistics & Scatter Plot**



A water quality criterion has not been developed for TSS. Since the various wastewater sources to the IWTB can be defined as “low volume waste” (see 40 CFR § 423.11 for definition), best practicable control technology currently available (BPT) is applicable. Based on 40 CFR § 423.12(b)(3) & (b)(10), 30.0 mg/L as a monthly average limit is recommended. The previous permit established an instantaneous maximum of 50.0 mg/L as per 40 CFR § 423.12 BPT requirements for “coal pile runoff” (see 40 CFR § 423.11 for definition). Since the 50.0 mg/L instantaneous maximum was previously established as a limit and is more stringent than the 100.0 mg/L instantaneous maximum required for BPT for low volume waste, and the IWTB accepts coal pile runoff, and the established limit is more

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

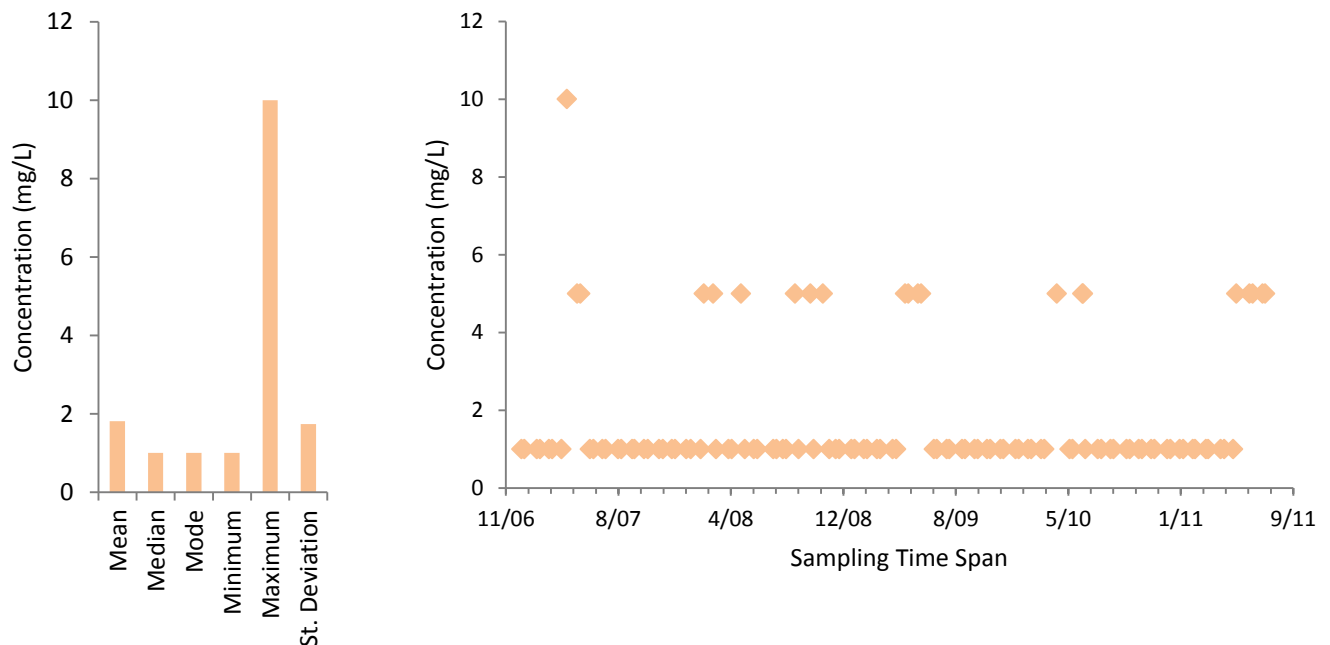
stringent than the Department's standard IW multiplier for effluent limits (see guidance no. 362-0400-001 10/1/1997), the established 50.0 mg/L instantaneous maximum limit is recommended. Per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island sample one per week using a 24-hr composite sample type.

### 7.5 Oil & Grease <sub>(O&G)</sub>

The graph below shows the sample results for the daily maximum O&G concentrations from the effluent at outfall 002. Oil & Grease has remained below the permitted daily maximum value of 20.0 mg/L and instantaneous maximum value of 30.0 mg/L.

Oil & Grease will remain in the permit per the Department's 25 Pa Code § 95.2(2)(ii) with a monthly average limit of 15.0 mg/L, maximum daily of 20.0 mg/L and an instantaneous maximum 30.0 mg/L. Additionally, the above monthly average and maximum daily values are in agreement with 40 CFR § 423.12(a)(3) BPT O&G effluent limitations.

**Figure 7-3. Outfall 002 O&G Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 7.6 Metals Discharge Data

Provided on the subsequent pages, are brief data summaries of each parameter sampled for, as well as accompanying bar graphs with descriptive statistics extracted from the discharge records reviewed from January 1<sup>st</sup>, 2007 to July 31, 2011. Unlike Outfall 001, data beyond the July 31<sup>st</sup> end date was not available when this portion of the review took place.

Since issuance of the current NPDES permit in 2006, the metal parameters have been sampled on quarterly basis; however, a subsequent amendment to the permit occurred in April of 2007, which resulted in additional sampling requirements. Therefore, most metals evaluated had 20 data points with the exception of selenium, which has 11 data points.

The table below provides the annual range of daily average effluent flows for Outfall 002 reported since the beginning of 2007 through the partial year of 2011.

Table 7-3. Outfall 002 Flows		
Year	Range of Flow (MGD)	
	Min	Max
2007	0	4
2008	0	8.3
2009	0	8.3
2010	0	6.1
2011	0.6	2.4

Given the variability of the influent wastewater flow and potential concentration fluctuations, it is recommended that the composite sampling for the metals be flow proportioned. See Attachment B for PENTOXSD results.

## Water Quality Protection Report

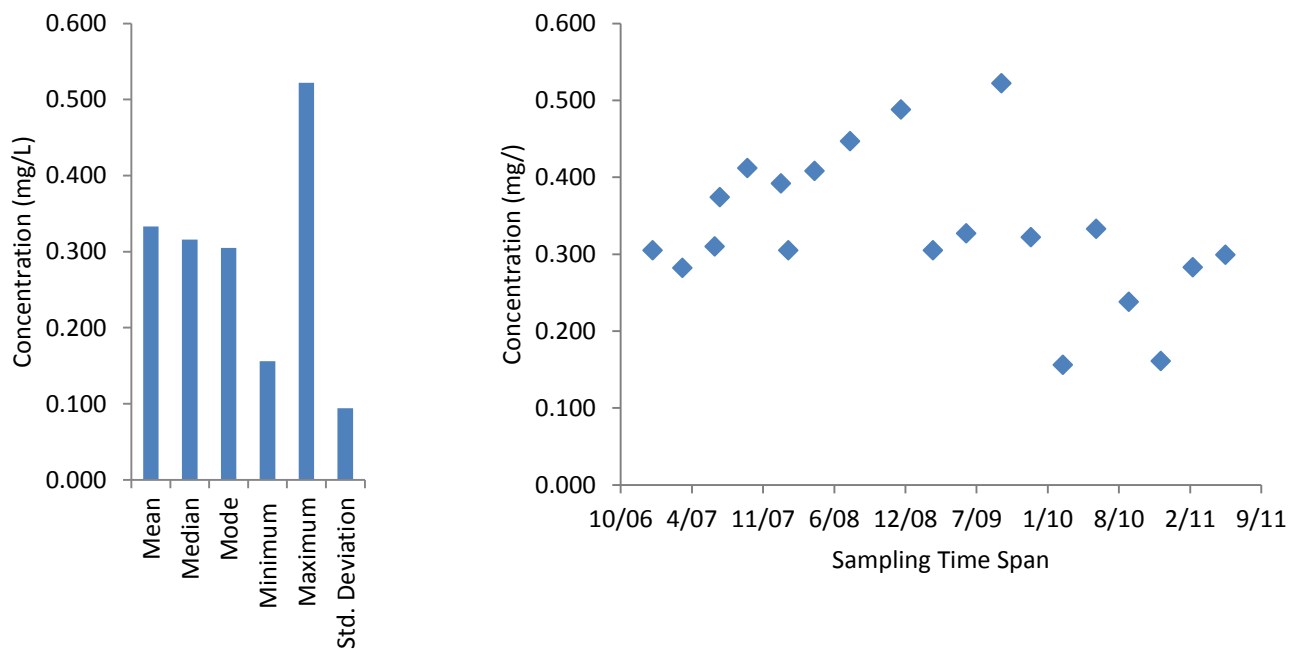
PPL Brunner Island, LLC

PA0008281

### 7.6.1 Aluminum

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 indicate the median aluminum concentration is 0.316 mg/L. The Department's PENTOXSD model calculates a monthly average aluminum limit of 3.196 mg/L (Acute Fish Criterion) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island's median effluent aluminum concentration is approximately 10% of the PENTOXSD result, the sample results are based on grab samples that may not fully characterize the aluminum concentration in the effluent. Based on PPL Brunner Island's NPDES application raw water sampling (3 grab samples) the total aluminum concentration averaged 0.04 mg/L. To confirm that the aluminum discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-4. Outfall 002 Aluminum Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

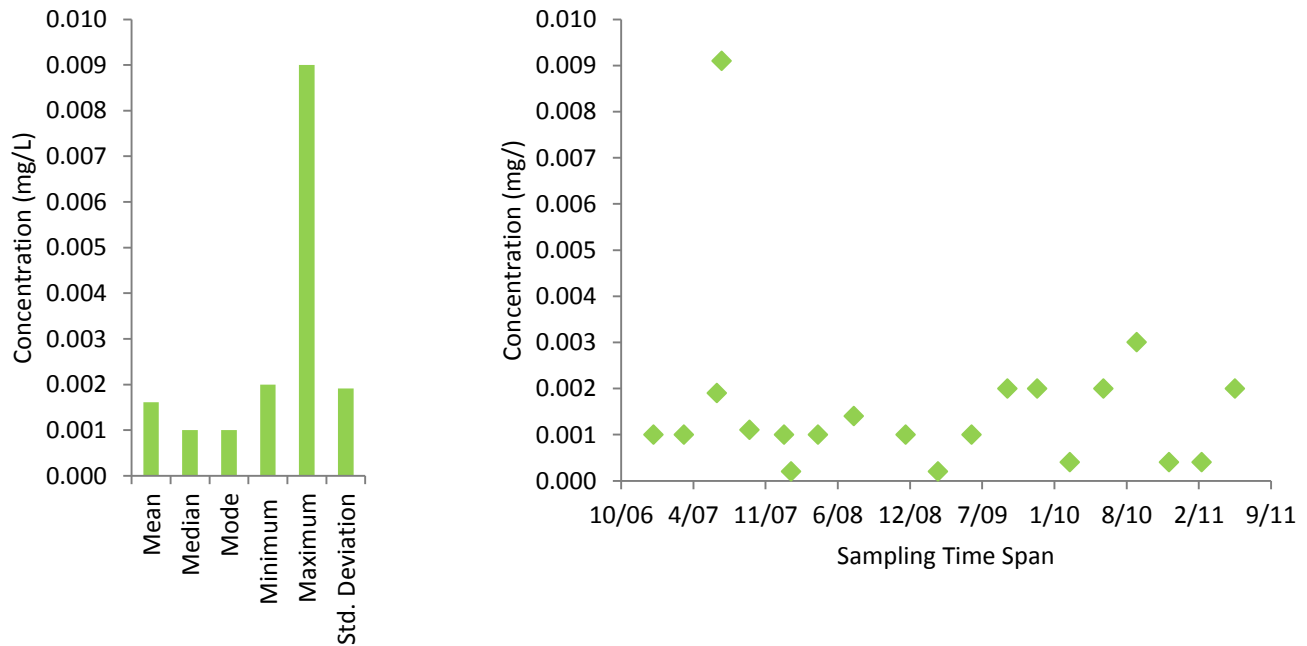
PPL Brunner Island, LLC

PA0008281

### 7.6.2 Arsenic

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 show a median arsenic concentration of 0.001 mg/L. The Department's PENTOXSD model calculates an arsenic limit of 0.401 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island's median effluent arsenic concentration is approximately 0.25% of the PENTOXSD result, the sample results are based on grab samples, which may not fully characterize the arsenic concentration in the effluent. Based on PPL Brunner Island's NPDES application raw water sampling data (3 grab samples), total arsenic averaged non-detect. To confirm that the arsenic discharge concentration does not pose a threat to human health and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-5. Outfall 002 Arsenic Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

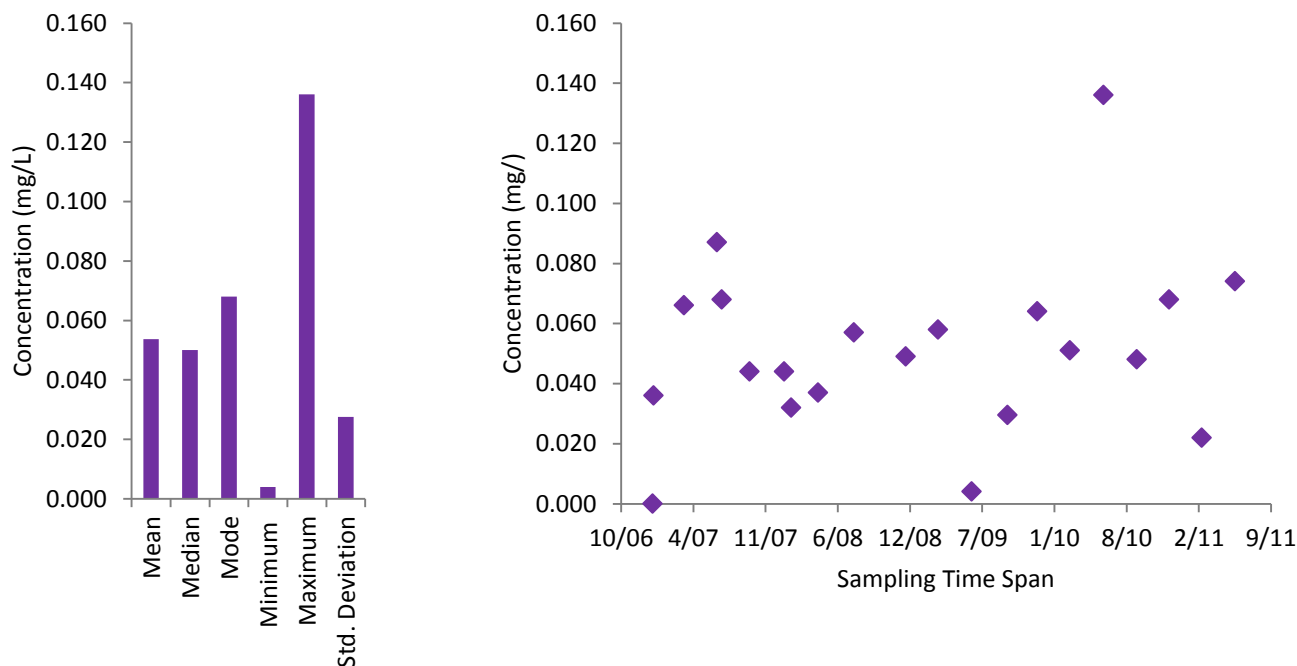
PPL Brunner Island, LLC

PA0008281

### 7.6.3 Boron

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 produce a median boron concentration of 0.050 mg/L. The Department's PENTOXSD model calculates a boron limit of 34.523 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent boron concentration is approximately 0.1 % of the PENTOXSD result. Additionally, Department inspector grab samples over several years indicated a consistent, but slightly higher concentration of 0.200 mg/L. Based on PPL Brunner Island's NPDES application raw water sampling data (3 grab samples) the total boron concentration averaged non-detect. Based on the boron limit generated by the PENTOXSD model relative to the median effluent concentration, it is recommended that boron be removed from the permit.

Figure 7-6. Outfall 002 Boron Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

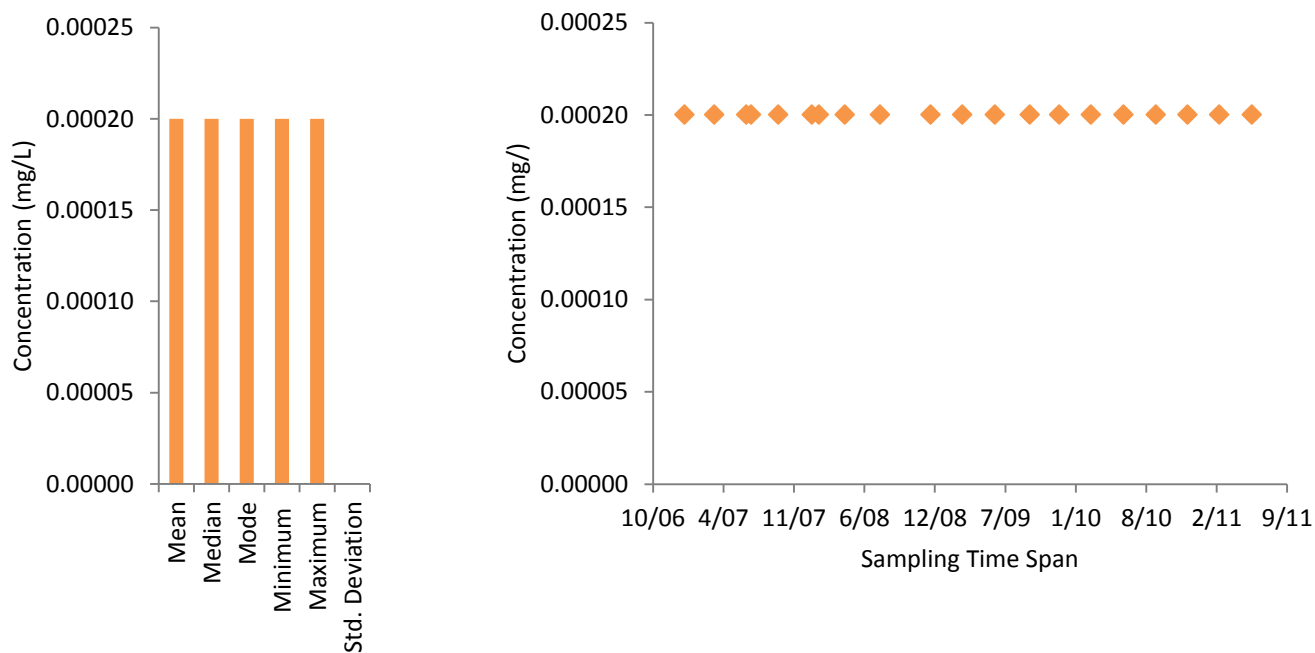
PPL Brunner Island, LLC

PA0008281

### 7.6.4 Cadmium

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median cadmium concentration of 0.0002 mg/L. The Department's PENTOXSD model calculates a cadmium limit of 0.009 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent cadmium concentration is approximately 2% of the PENTOXSD result. Department inspector grab samples in 2007 and 2008 indicated a cadmium concentration of 0.01 mg/L. Based on PPL Brunner Island's NPDES application raw water sampling data (3 grab samples) the total cadmium concentration averaged non-detect. To confirm that the cadmium discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-7. Outfall 002 Cadmium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

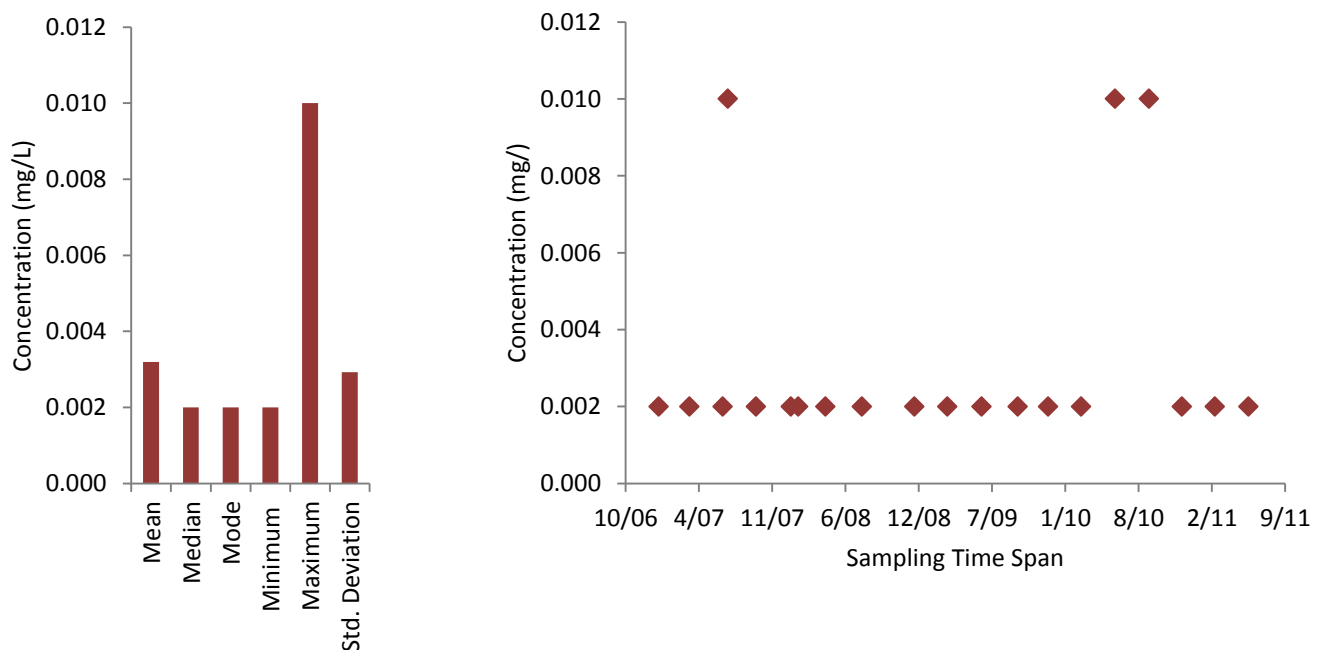
PPL Brunner Island, LLC

PA0008281

### 7.6.5 Chromium

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 show a median total chromium concentration of 0.002 mg/L. The Department's PENTOXSD model does not recognize total chromium as an input, but rather splits the chromium into trivalent chromium ( $\text{Cr}^{3+}$ ) and hexavalent chromium ( $\text{Cr}^{6+}$ ). For the trivalent chromium parameter, the PENTOXSD model calculated a limit is 3.459 mg/L (Chronic Fish Criteria), and for the hexavalent chromium parameter, the PENTOXSD model calculated a limit is 0.069 mg/L (Acute Fish Criteria), both at  $Q_{7-10}$  conditions. Based on PPL Brunner Island's NPDES application raw water sampling data (3 grab samples), both the total  $\text{Cr}^{3+}$  and  $\text{Cr}^{6+}$  concentrations averaged non-detect, respectively. Since the median concentration for total chromium remains low compared to the trivalent chromium, but not the hexavalent chromium, and based on EPA's identification of hexavalent chromium as pollutant of concern in document no. EPA-821-R-09-008, it is recommended that PPL Brunner Island sample for hexavalent chromium. Per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

Figure 7-8. Outfall 002 Chromium Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

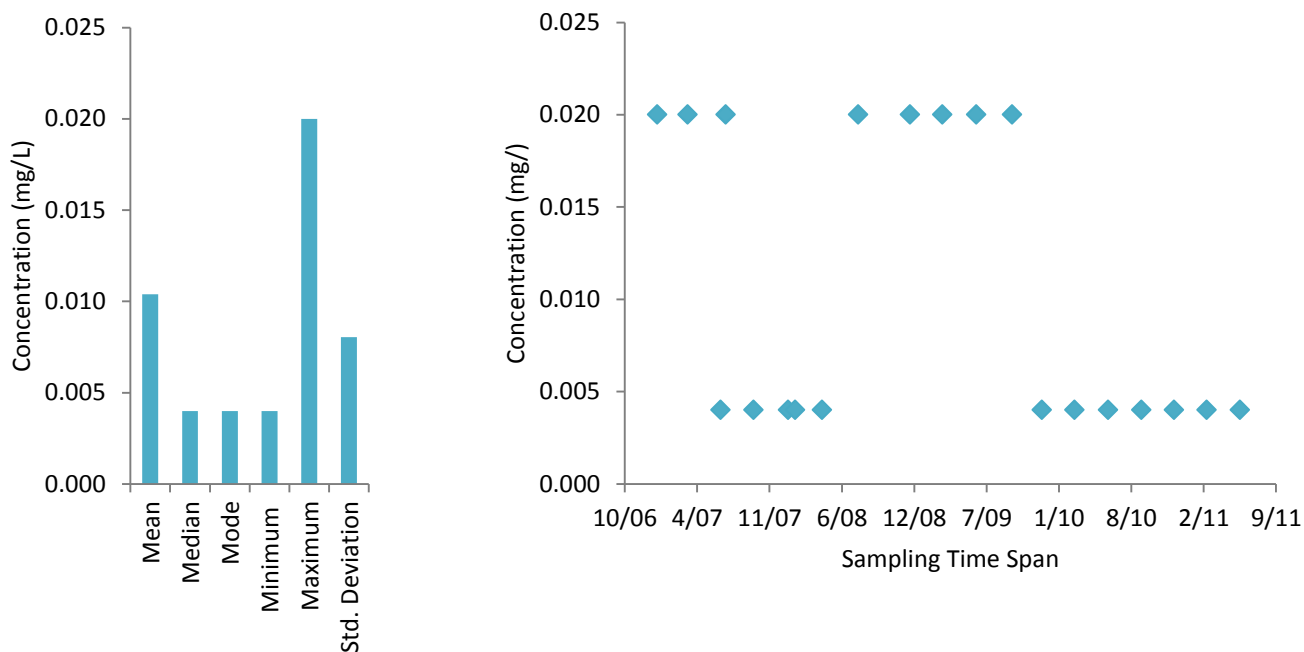
PPL Brunner Island, LLC

PA0008281

### 7.6.6 Copper

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup> 2011 produce a median copper concentration of 0.004 mg/L. The Department's PENTOXSD model calculates a copper limit of 0.059 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island's median effluent cadmium concentration is approximately 7% of the PENTOXSD result. Based on PPL Brunner Island's NPDES application raw water sampling data (3 grab samples) the total copper concentration averaged non-detect. To confirm that the copper discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

Figure 7-9. Outfall 002 Copper Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

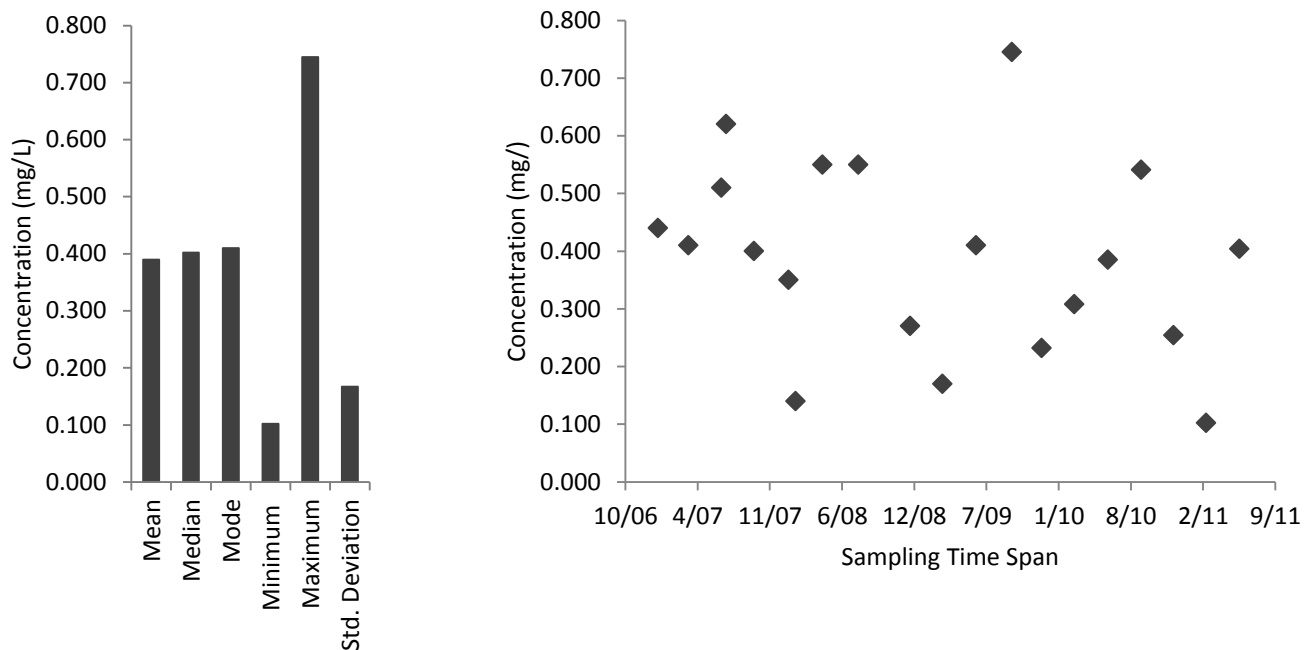
PPL Brunner Island, LLC

PA0008281

### 7.6.7 Iron

The reported grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 show a median iron concentration of 0.402 mg/L. The Department's PENTOXSD model calculates an iron limit of "input value" at Q<sub>7-10</sub> conditions. The "input value" was returned by the PENTOXSD model because a PWS Withdrawal was not identified in the stream reach for the model. Since the discharge is not anticipated to impact the PWS intake, which is approximately 9.8 miles downstream, and the Department inspector grab samples were within the PPL sample result range, and PENTOXSD did not identify a limit of concern for aquatic life, it is recommended that iron be removed from the sampling regime for outfall 002.

Figure 7-10. Outfall 002 Iron Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

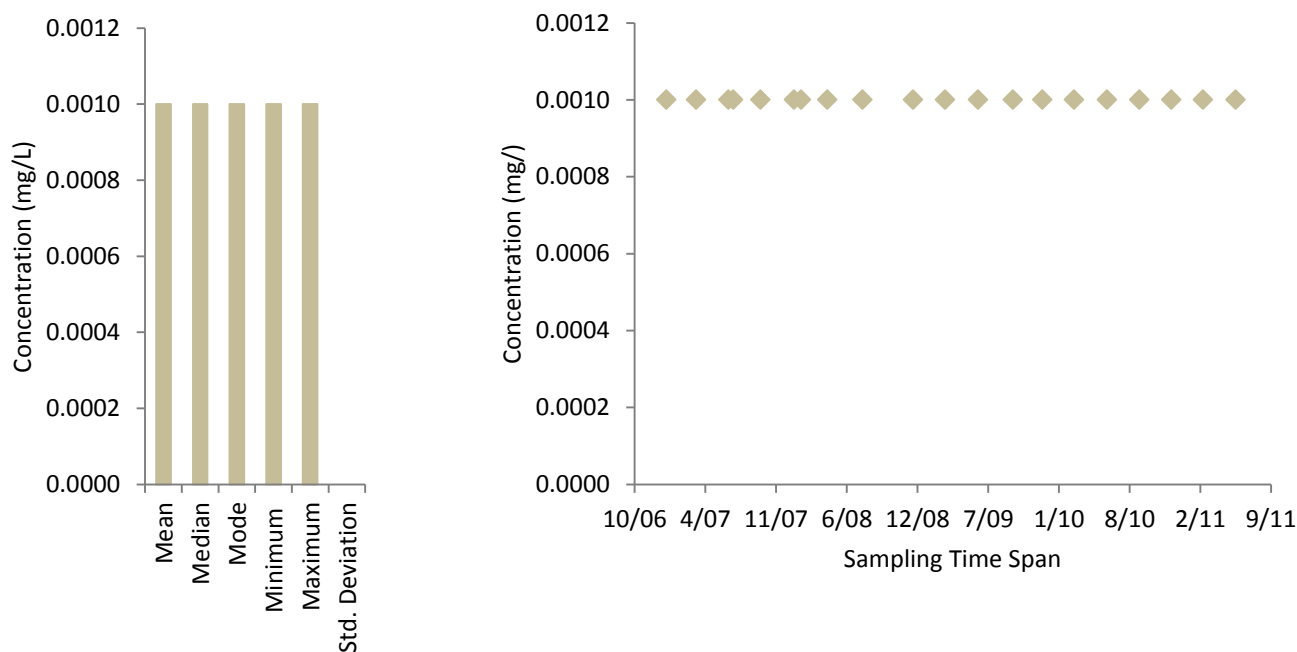
PPL Brunner Island, LLC

PA0008281

### 7.6.8 Lead

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median lead concentration of 0.001 mg/L. The Department's PENTOXSD model calculates a lead limit of 0.127 mg/L (Chronic Fish Criteria) at  $Q_{7-10}$  conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent lead concentration is approximately 0.8% of the PENTOXSD result. Additionally, Department inspector grab samples consistently confirm the lead concentration from outfall 002 is 0.001 mg/L. To confirm that the lead discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-11. Outfall 002 Lead Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

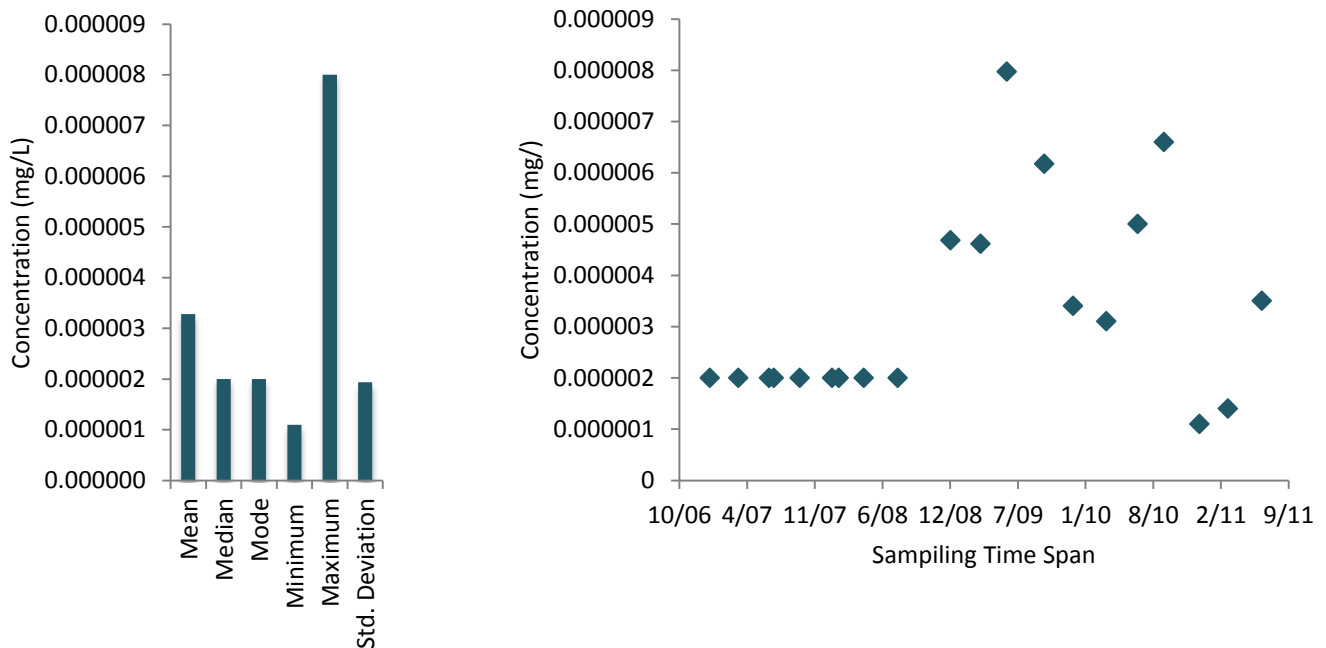
PPL Brunner Island, LLC

PA0008281

### 7.6.9 Mercury

The reported grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 produce a median mercury concentration of 0.000002 mg/L. The Department's PENTOXSD model calculates a mercury limit of 0.002 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island's median effluent mercury concentration is approximately 0.1% of the PENTOXSD result. To confirm that the mercury discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-12. Outfall 002 Mercury Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

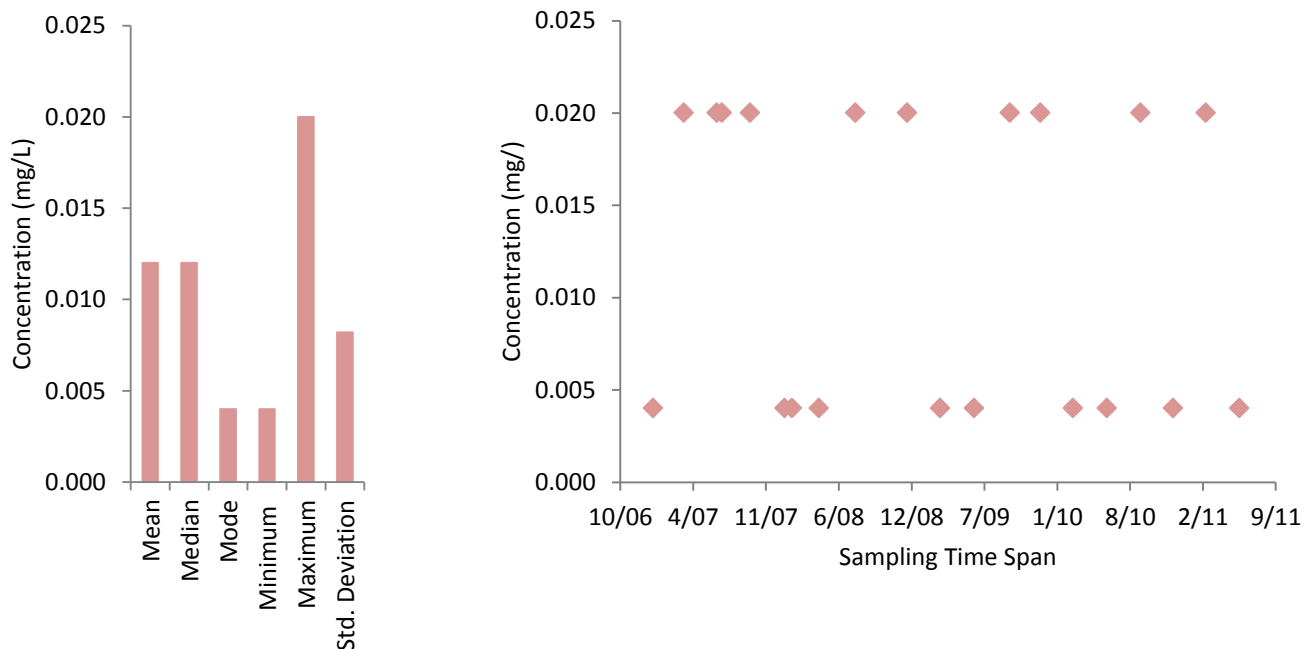
PPL Brunner Island, LLC

PA0008281

### 7.6.10 Molybdenum

PPL Brunner Island's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 show a median molybdenum concentration of 0.012 mg/L. The Department's PENTOXSD model does not contain a criterion for molybdenum; however, the Department's Central Office technical staff provided provisional molybdenum criteria of 0.000210 mg/L (Human Health Criteria). The sampling data indicates PPL Brunner Island, LLC's median effluent molybdenum concentration is approximately 1.6% of the PENTOXSD result. This value when used in the PENTOXSD model, produces an effluent limit concentration of 8.429 mg/L. Department inspector grab samples in 2007 and 2008 produced a concentration of 0.070 mg/L. Since the median concentration remains low compared to the sample results and the current criteria is provisional, no limit is recommended. However, because the parameter is a concern to human health and the criterion is provisional, and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-13. Outfall 002 Molybdenum Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

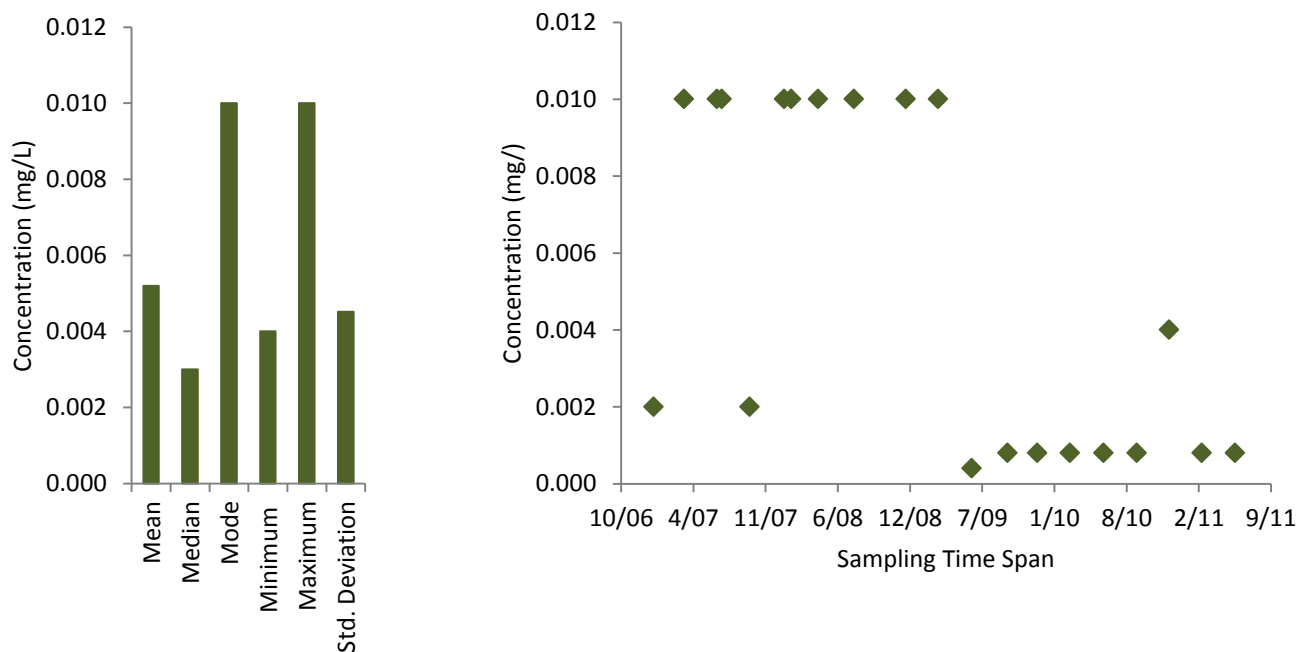
PPL Brunner Island, LLC

PA0008281

### 7.6.11 Nickel

The reported grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011 produce a median nickel concentration of 0.003 mg/L. The Department's PENTOXSD model calculates a nickel limit of 1.999 mg/L (Aquatic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island's median effluent nickel concentration is approximately 0.1% of the PENTOXSD result. The Department inspector grab sample results in 2007 and 2008 produced a concentration of 0.05 mg/L. To confirm that the nickel discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 7-14. Outfall 002 Nickel Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

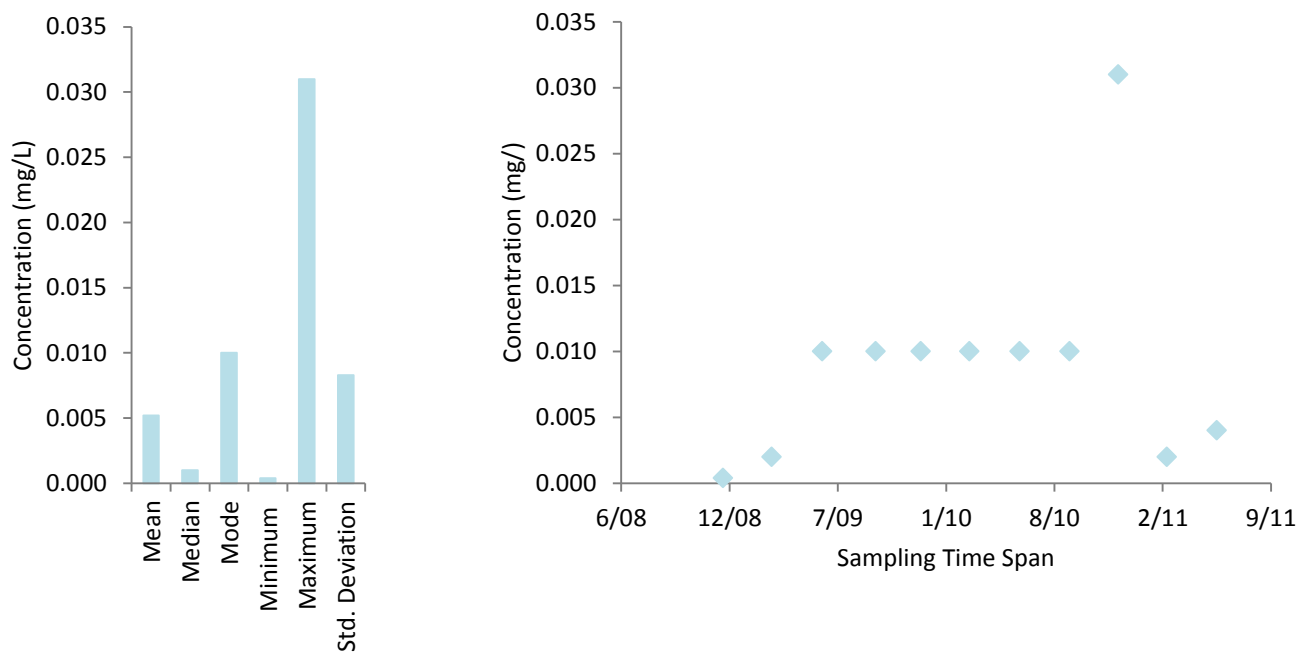
PPL Brunner Island, LLC

PA0008281

### 7.6.12 Selenium

PPL Brunner Island's grab sample results for the period from December 6<sup>th</sup>, 2008 to July 31<sup>st</sup>, 2011 show a median selenium concentration of 0.001 mg/L. The Department's PENTOXSD model calculates a selenium limit of 0.002 mg/L (Chronic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island's median effluent selenium concentration is approximately 50.0% of the PENTOXSD result. Department inspector grab samples in 2007 and 2008 showed a selenium concentration of 0.007 mg/L and 0.0144 mg/L, respectively. Additionally, a single daily value reported by PPL Brunner Island indicated a concentration of 0.031 mg/L. To confirm that the selenium discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

Figure 7-15. Outfall 002 Selenium Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

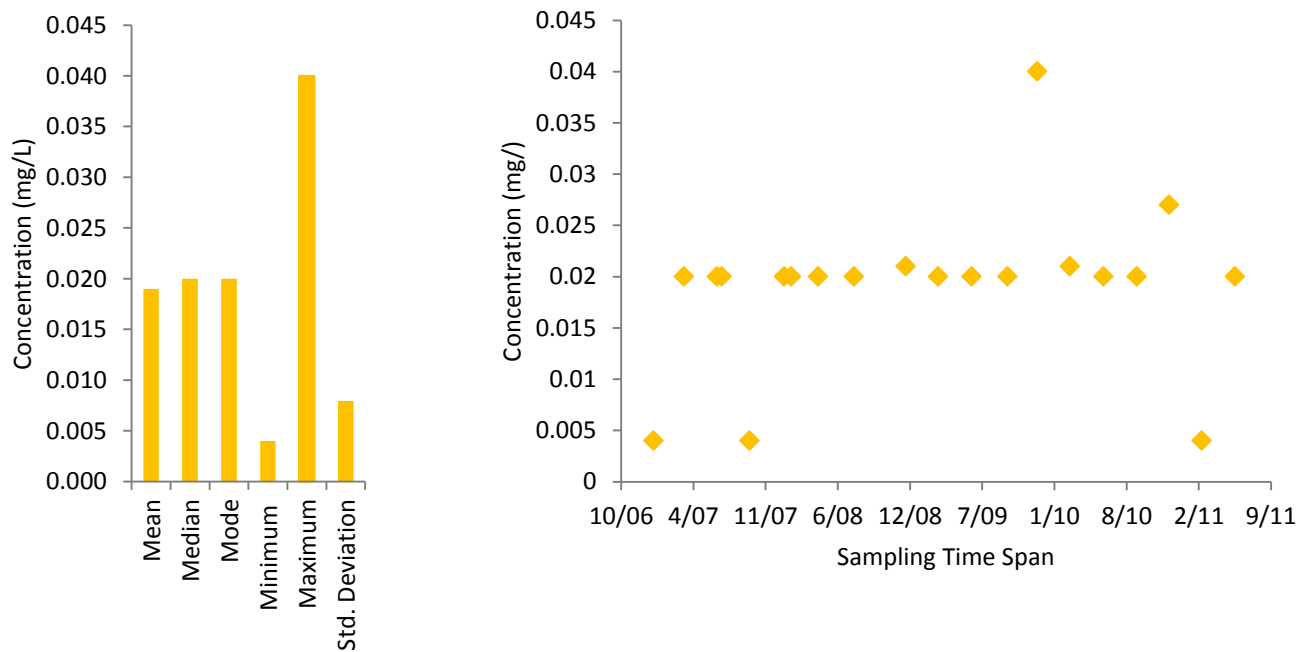
PPL Brunner Island, LLC

PA0008281

### 7.6.13 Zinc

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median zinc concentration of 0.02 mg/L. The Department's PENTOXSD model calculates a zinc limit of 0.510 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent zinc concentration is approximately 4% of the PENTOXSD result. Department inspector grab samples in 2007 and 2008 showed a selenium concentration of 0.001 mg/L and 0.024 mg/L, respectively. To confirm that the zinc discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

Figure 7-16. Outfall 002 Zinc Concentration Descriptive Statistics & Scatter Plot



# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 7.7 Recommended Limits

**Table 7-4. Outfall 002 Recommended Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15.0	20.0	30.0	1/week	Grab
TSS	XXX	XXX	30.0	50.0	50.0	1/week	24-hr comp
Total Aluminum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Arsenic	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Cadmium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Hexavalent Chromium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Copper	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Lead	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Mercury	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Molybdenum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Nickel	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Selenium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Zinc	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 8. Outfall 003-Sewage Treatment Plant (WWTP)

The WWTP receives sewage, laboratory water and backwash water from the water treatment plant. Based on the PPL BISES NPDES renewal application, dated March 18, 2011, the monthly average discharge rate is 0.017 with a maximum daily average rate is 0.052 MGD. The previous annual average flow of 0.02 MGD will be used. The STP treatment process is as follows:

Communitor (1) ⇒ Equalization Tank (1) ⇒ Aeration Tank (3) ⇒ Settling Basin (3) ⇒ Chlorine Contact Tank (2) ⇒ Dechlorination ⇒ Discharge to the Susquehanna River

### 8.1 Existing Limits

**Table 8-1. Existing Outfall 003 Discharge Limits**

DISCHARGE LIMITATIONS									MONITORING REQUIREMENTS	
Discharge Parameter	Average Monthly	Mass Units (lbs/day)			Concentrations (mg/l)				Monitoring Frequency	Sample Type
		Maximum Daily	Total Monthly (lbs)	Total Annual (lbs)	Inst. Minimum	Average Monthly	Maximum Daily	Inst. Maximum		
Flow (mgd)	Report	Report	XXX	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	XXX	XXX	From 6.0 to 9.0 S.U.				1/day	Grab
D.O.	XXX	XXX	XXX	XXX	5.0	XXX	XXX	XXX	1/day	Grab
Total Residual Chlorine	XXX	XXX	XXX	XXX	XXX	1.0	XXX	2.0	1/day	Grab
Total Suspended Solids	XXX	XXX	XXX	XXX	XXX	30	XXX	60	2/month	8-hour comp
CBOD <sub>5</sub>	XXX	XXX	XXX	XXX	XXX	25	XXX	50	2/month	8-hour comp
Fecal Coliform (5/1 to 9/30)	XXX	XXX	XXX	XXX	XXX	200	XXX	XXX	2/month	Grab
Fecal Coliform (10/1 to 4/30)	XXX	XXX	XXX	XXX	XXX	2000	XXX	XXX	2/month	Grab
Total Phosphorus	XXX	XXX	Report	Report	XXX	2.0	XXX	XXX	2/month	8-hour comp
NH <sub>3</sub> -N	XXX	XXX	Report	XXX	XXX	Report	XXX	3.0	1/month	8-hour comp
Total Nitrogen	XXX	XXX	Report	Report	XXX	Report	XXX	XXX	1/month	Calc
Total Kjeldahl Nitrogen	XXX	XXX	Report	XXX	XXX	Report	XXX	XXX	1/month	8-hour comp
Nitrate-Nitrite	XXX	XXX	Report	XXX	XXX	Report	XXX	XXX	1/month	8-hour comp

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 8.2 Carbonaceous Biochemical Oxygen Demand (CBOD<sub>5</sub>)

The attached computer printout from the WQM 7.0 stream model indicates that secondary treatment is adequate to protect the water quality of the Susquehanna River. Secondary treatment is recommended for this permit cycle. The WQM 7.0 calculates a CBOD<sub>5</sub> average monthly limit of 25.0 mg/L. The WQM average monthly limit is recommended for the NPDES permit. See Attachment B for WQM Results

### 8.3 Ammonia (NH<sub>3</sub>N)

NH<sub>3</sub>-N calculations are based on the Department's Implementation Guidance of Section 93.7 Ammonia Criteria, dated 11/4/97 (ID No. 391-2000-013). The following data is necessary to determine the in stream NH<sub>3</sub>-N criteria used in the attached computer model of the stream:

WWTP pH	=	7.0	(Default)
WWTP Temp	=	25°C	(Default)
Stream pH	=	7.0	(Default)
Stream Temp	=	20°C	(Default)
Background NH <sub>3</sub> N	=	0	(Default)

The attached computer printout of the WQM 7.0 stream model indicates that at a discharge of 0.020 MGD; an average monthly limit of 25.0 mg/L NH<sub>3</sub>-N and 50.0 mg/L NH<sub>3</sub>-N instantaneous maximum are necessary to protect the aquatic life from toxicity effects. Secondary treatment is recommended for this permit cycle. Based on the Department's guidance document titled Implementation Guidance of Section 93.7 Ammonia Criteria (Doc. No. 391-2000-013) dated November 4th, 1997, if the ammonia limit is greater than 15.0 mg/L, no limit is necessary. It is recommended ammonia be reported

### 8.4 Total Nitrogen (TN) & Total Phosphorus (TP)

A TN limit is no longer necessary for the PPL BISES WWTP, as the "two year data" criteria for the Chesapeake Bay Tributary Strategy (CBTS) has been satisfied. The CBTS states the following:

"When and if phase 5 is reached (not before 1/1/2013), existing smaller dischargers (less than 0.2 MGD) would be required, at permit renewal, to monitor and report on levels of TN and TP in their discharge for a minimum of two years<sup>2</sup>.....The purpose of data collection for these facilities is to establish existing performance for TN and TP effluent quality. This existing performance data may be used to establish cap loads at some point in the future.....<sup>2</sup> Note that if two years of monitoring data already exist for the facility, no additional monitoring needs to be done."

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The DMR data from January 2007 through April 2011 containing TN & TP sample results are attached to the end of this report. The tables on the subsequent page provide a basic statistical summarization of the nutrient data (54 sample results) and attached to the end of the Water Quality Protection Report is the entire DMR sampling history from January 2007 to April 2011.

<b>Table 8-2. Total Phosphorus Outfall 003 Statistics</b>	
Mean	0.610 mg/L
Median	0.520 mg/L
Mode	0.540 mg/L
Minimum Value	0.210 mg/L
Maximum Value	1.600 mg/L

<b>Table 8-3. Total Nitrogen Outfall 003 Statistics</b>	
Mean	26.16 mg/L
Median	26.55 mg/L
Mode	27.90 mg/L
Minimum Value	12.90 mg/L
Maximum Value	45.60 mg/L

The previous protection reports established a TP limit of 2.0 mg/L. Although the previous limit was based on a prior South Central Regional Office policy concerning loading to the Lower Susquehanna River, the 2.0 mg/L will remain in the permit in accordance with anti-backsliding policy and because the WWTP does have the capability to adequately remove phosphorus.

### 8.5 Total Suspended Solids (TSS)

A water quality criterion has not been developed for TSS. A limit of 30.0 mg/L will be required based on the minimum level of effluent quality attainable by secondary treatment as defined in 40 CFR 133.102(b).

### 8.6 Dissolved Oxygen (D.O)

A minimum D.O. of 5.0 mg/L is required per 25 Pa. Code § 93.7. This is consistent with the previous permit and current Department criteria.

### 8.7 pH

The effluent discharge pH should remain above 6 and below 9 standard units according to 25 Pa Code § 95.2(1)(i).

### 8.8 Total Residual Chlorine (TRC)

The Department's TRC Excel Spreadsheet calculator, which uses the equations and calculations from the Department's Implementation Guidance for Total Residual Chlorine (ID No. 391-2000-015) dated May 1, 2003, produces an average monthly limit of 0.5 mg/L. This is consistent with the Department's 25 Pa Code § 92a.48(b)(2).



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 8.9 Fecal Coliform

Per 25 Pa Code § 92a.47, the PPL BISES WWTP must meet a geometric mean of 200 CFUs/100 mL with an instantaneous maximum of 1,000 CFUs/100 mL from May 1st to September 30 and a geometric mean of 2,000 CFUs/100 mL from October 1st to April 30th with an instantaneous maximum of 10,000 CFUs/100 mL in the final effluent.

### 8.10 Recommended Limits

**Table 8-5. Outfall 003 Recommended Discharge Limits**

DISCHARGE LIMITATIONS									MONITORING REQUIREMENTS	
Discharge Parameter	Average Monthly	Mass Units (lbs/day)			Concentrations (mg/l)				Monitoring Frequency	Sample Type
		Maximum Daily	Total Monthly (lbs)	Total Annual (lbs)	Inst. Minimum	Average Monthly	Maximum Daily	Inst. Maximum		
Flow (mgd)	Report	Report	XXX	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	XXX	XXX	From 6.0 to 9.0 S.U.				1/day	Grab
D.O.	XXX	XXX	XXX	XXX	5.0	XXX	XXX	XXX	1/day	Grab
Total Residual Chlorine	XXX	XXX	XXX	XXX	XXX	0.5	XXX	1.0	1/day	Grab
Total Suspended Solids	XXX	XXX	XXX	XXX	XXX	30	XXX	60	2/month	24-hour comp
CBOD <sub>5</sub>	XXX	XXX	XXX	XXX	XXX	25	XXX	50	2/month	24-hour comp
Fecal Coliform (5/1 to 9/30) (CFU/100 mL)	XXX	XXX	XXX	XXX	XXX	200	XXX	1,000	2/month	Grab
Fecal Coliform (10/1 to 4/30) (CFU/100 mL)	XXX	XXX	XXX	XXX	XXX	2,000	XXX	10,000	2/month	Grab
Total Phosphorus	XXX	XXX	Report	Report	XXX	2.0	XXX	XXX	2/month	24-hour comp
NH <sub>3</sub> -N	XXX	XXX	Report	XXX	XXX	Report	XXX	XXX	1/month	24-hour comp

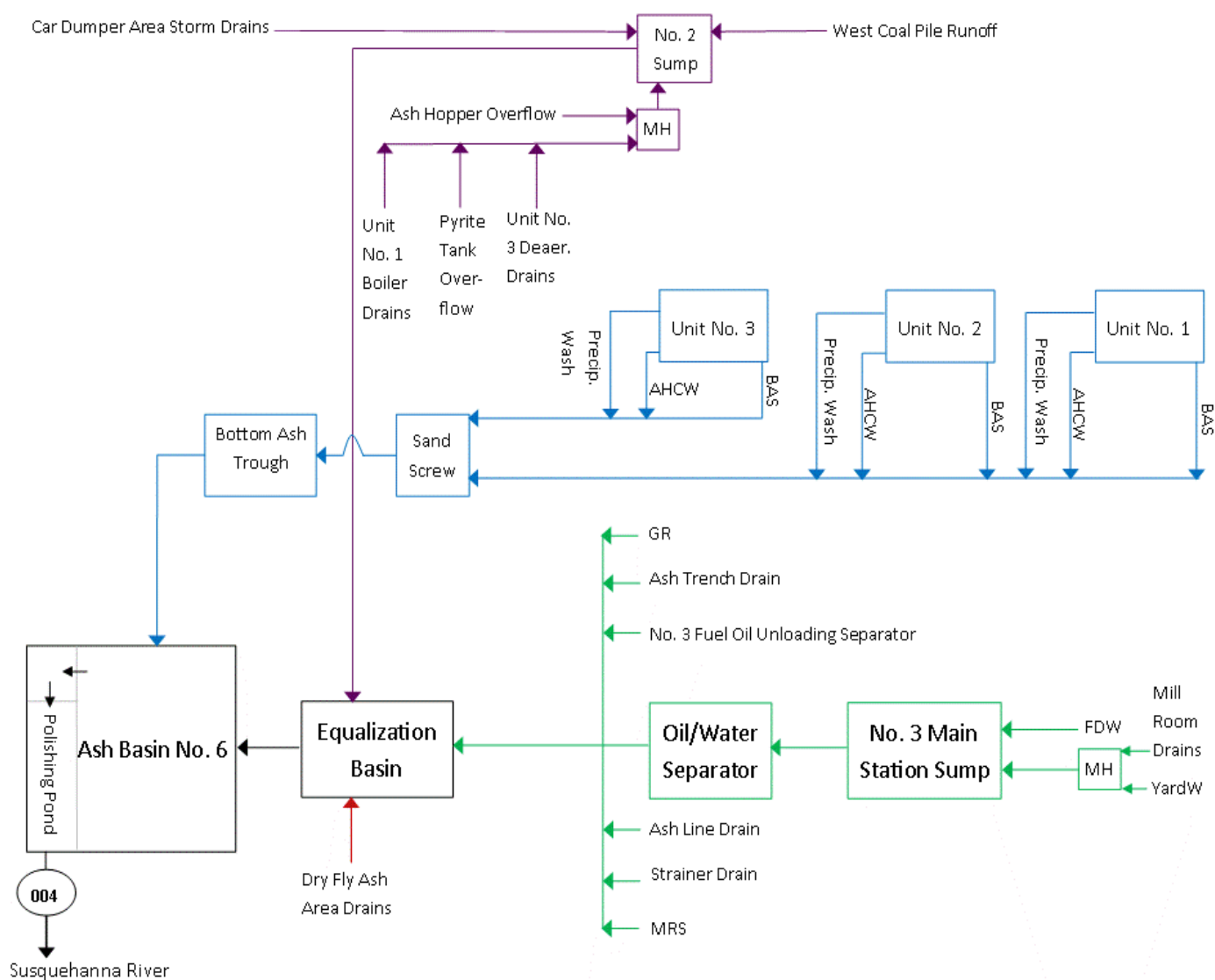
# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 9. Outfall 004-Ash Basin No. 6

The Ash Basin No. 6 receives wastewater and storm water from several sources within the PPL BISES site. Based on the PPL BISES NPDES renewal application, dated March 18, 2011, the long term average discharge rate is 4.8 MGD with a maximum daily discharge rate of 11.2 MGD. **Figure 9-1. Wastewater flows from the various system processes to the Ash Basin No. 6.**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 9-1. Schematic Abbreviations Ash Basin No. 6**

BAS	Bottom Ash Sluice		MH	Manhole
FDW	Floor Drain Water		MRS	Mill Reject Sluice
GR	Groundwater		YardW	Yard Drain Washwater

The Ash Basin No. 6 currently discharges through outfall 004 to the Susquehanna River; however, PPL Brunner Island, LLC will be closing out Ash Basin No. 6. PPL has requested in the renewal application that the outfall remain in the permit, until the basin is closed out. Eventually all wastewater flows that normally flow to the Ash Basin No. 6, will flow to a new industrial wastewater treatment plant (IWTP) that is currently under construction. The new IWTP is slated to be operational by April of 2012.

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 9.1 Existing Limits

The current NPDES permit, permit cycle October 1<sup>st</sup>, 2006 to September 30, 2011, requires the following parameters be sampled for (**Table 9-2. Existing Outfall 004 Discharge Limits**):

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	2/month	Grab
TSS	XXX	XXX	30	60	75	1/week	24-hr comp
Total Aluminum	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Arsenic	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Boron	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Cadmium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Chromium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Copper	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Iron	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Lead	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Mercury	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Molybdenum	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Nickel	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Selenium	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab
Total Zinc	XXX	XXX	XXX	M&R	XXX	1/quarter	Grab

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

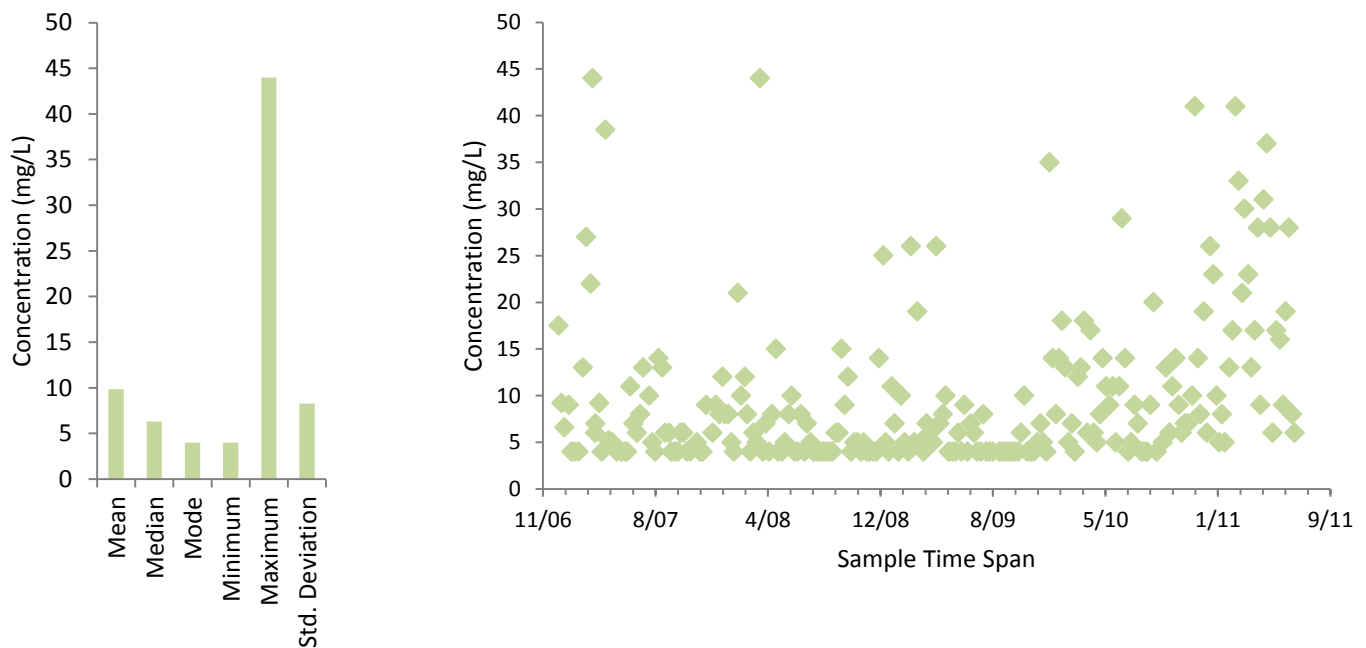
## 9.2 pH

The effluent discharge pH is required to remain above 6 and below 9 standard units (S.U.) according to 25 Pa Code § 95.2(1)(i).

## 9.3 Total Suspended Solids (TSS)

The grab sample results for the daily maximum TSS concentrations from the effluent at outfall 004 have remained below the permitted daily maximum value of 60.0 mg/L.

**Figure 9-2. Outfall 004 TSS Concentration Descriptive Statistics & Scatter Plot**



A water quality criterion has not been developed for TSS. Since the wastewater sources to Ash Basin No. 6 are defined as “fly ash” and “bottom ash” (see 40 CFR § 423.11 for definition), best practicable control technology currently available (BPT) is applicable. Based on 40 CFR § 423.12(b)(4), 30.0 mg/L as a monthly average limit is recommended. The previous permit established an instantaneous maximum of 75.0 mg/L as per 40 CFR § 423.12 BPT requirements for “coal pile runoff” (see 40 CFR § 423.11 for definition). Since the 75.0 mg/L instantaneous maximum was previously established as a limit and is more stringent than the 100.0 mg/L instantaneous maximum required for BPT for fly ash and bottom ash transport water, the established 75.0 mg/L instantaneous maximum limit is

## Water Quality Protection Report

PPL Brunner Island, LLC

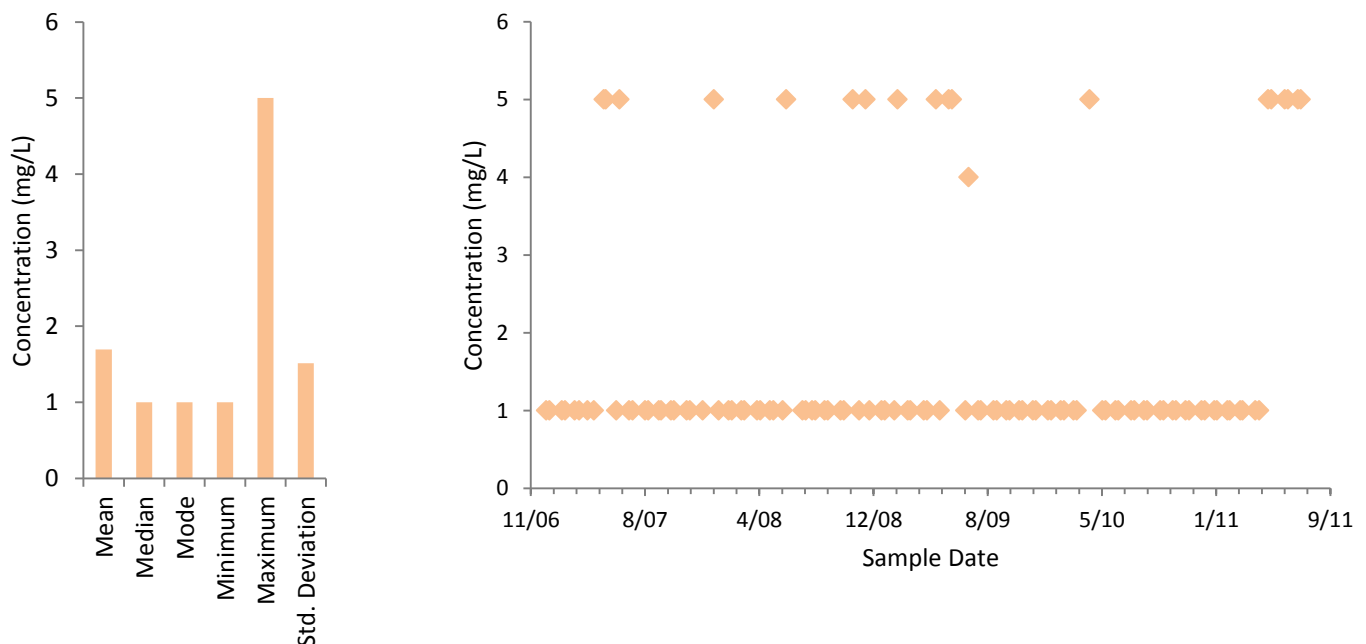
PA0008281

recommended. The Department's NPDES guidance document, no. 362-0400-001 (10/97), recommends a sample requirement of once per week using a 24-hr composite sample type and because this sampling requirement exist in the current permit, PPL Brunner Island is recommended to using this sample method until Ash Basin No. 6 is closed.

### 9.4 Oil & Grease <sub>(O&G)</sub>

The graph below shows the sample results for the daily maximum O&G concentrations from the effluent at outfall 002. Oil & Grease has remained below the permitted daily maximum value of 20.0 mg/L and instantaneous maximum value of 30.0 mg/L.

**Figure 9-3. Outfall 004 O&G Concentration Descriptive Statistics & Scatter Plot**



Oil & Grease will remain in the permit per the Department's 25 Pa Code § 95.2(2)(ii) with a monthly average limit of 15.0 mg/L, maximum daily of 20.0 mg/L and an instantaneous maximum 30.0 mg/L. Additionally, the above monthly average and maximum daily values are in agreement with 40 CFR § 423.12(a)(3) BPT O&G effluent limitations.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 9.5 Metals Discharge Data

Provided below and on the subsequent pages are bar graphs with descriptive statistics extracted from the discharge records reviewed from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011. Since the current NPDES permit was issued in 2006, the metal parameters have been sampled on quarterly basis; however, an amendment to the permit occurred in April of 2007, which resulted in additional sampling requirements. Almost all of the metals evaluated had 22 data points with the exception of Mercury (20 data points), Nickel (18 data points) and Selenium (17 data points).

The table below provides the annual range of daily average effluent flows for Outfall 004 reported since January 1<sup>st</sup>, 2007 through July 31<sup>st</sup>, 2011.

Table 9-3. Outfall 004 Flows		
Year	Range of Flow (MGD)	
	Min	Max
2007	2.3	11.9
2008	2.3	14.25
2009	1.49	9.78
2010	1.14	15.05
2011	2.74	9.09

Although the flow is variable, as PPL Brunner Island works through closure of the basin, it is anticipated that these flows will become significantly less with the wastewater rerouted to the new IWTP. See Attachment B for PENTOXSD results.

## Water Quality Protection Report

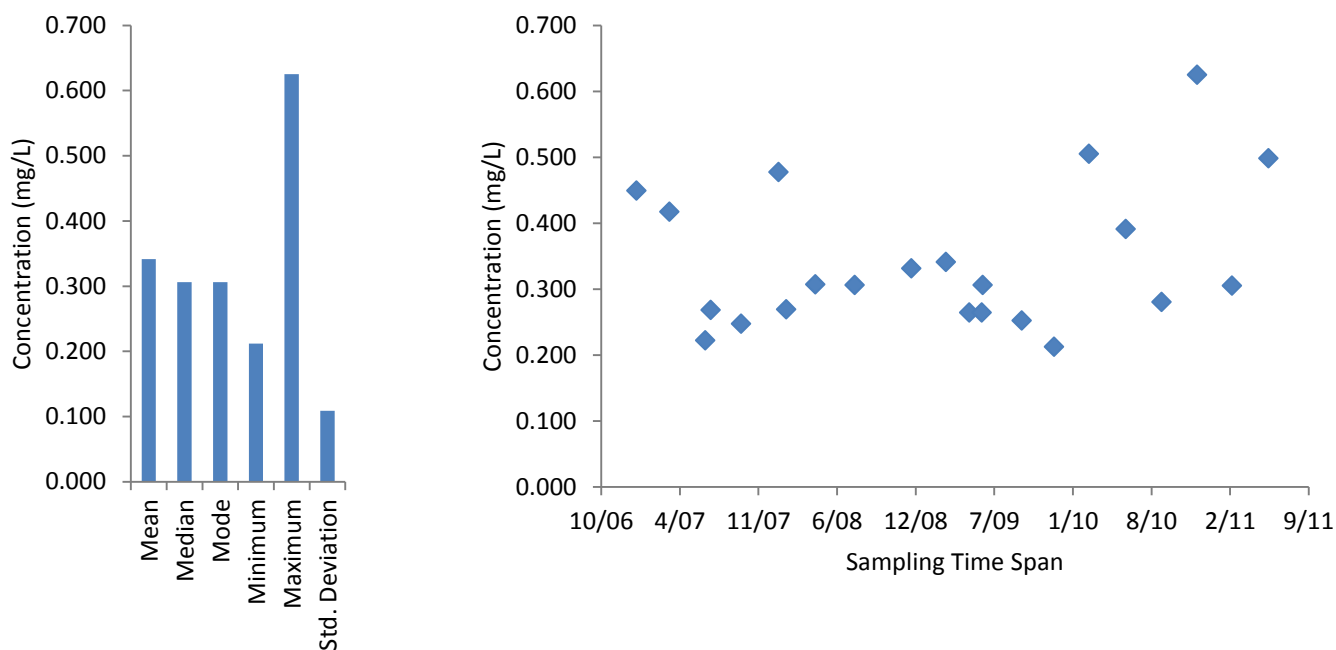
PPL Brunner Island, LLC

PA0008281

### 9.5.1 Aluminum

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median aluminum concentration of 0.306 mg/L. The Department's PENTOXSD model calculates an aluminum limit of 1.818 mg/L (Acute Fish Criterion) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island, LLC's median effluent aluminum concentration is approximately 17% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-4. Outfall 004 Aluminum Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

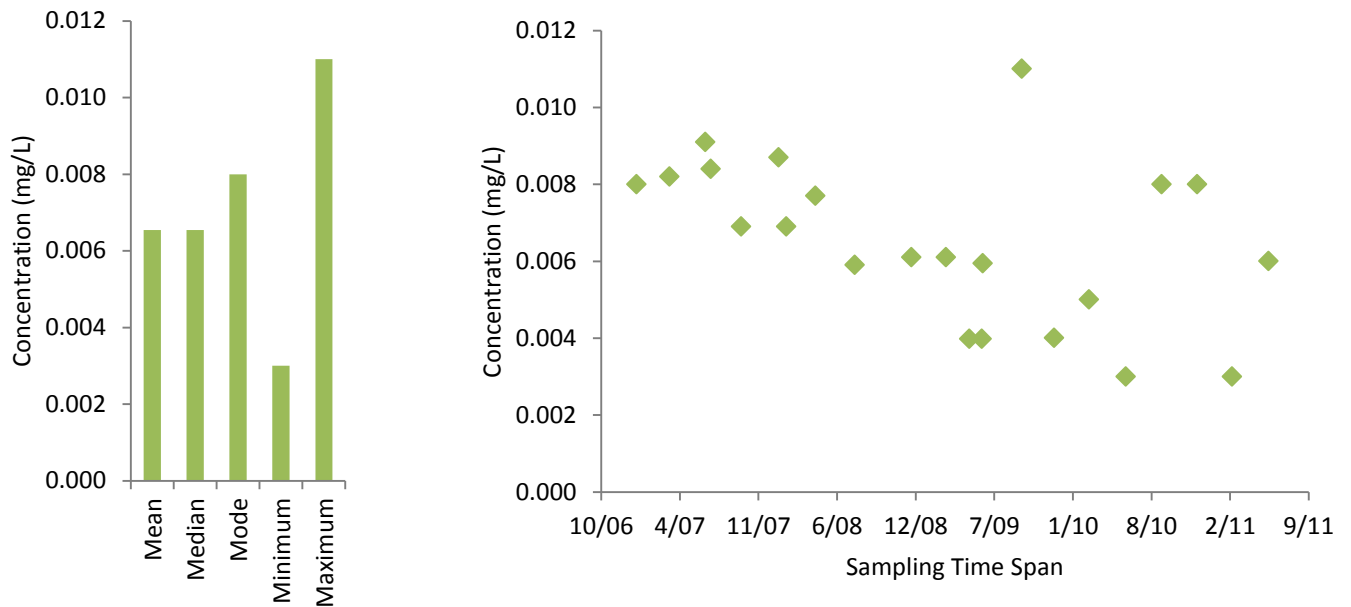
PPL Brunner Island, LLC

PA0008281

### 9.5.2 Arsenic

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median arsenic concentration of 0.007 mg/L. The Department's PENTOXSD model calculates an arsenic limit of 0.202 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island, LLC's median effluent arsenic concentration is approximately 3.5% of the PENTOXSD result, the sample results. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-5. Outfall 004 Arsenic Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

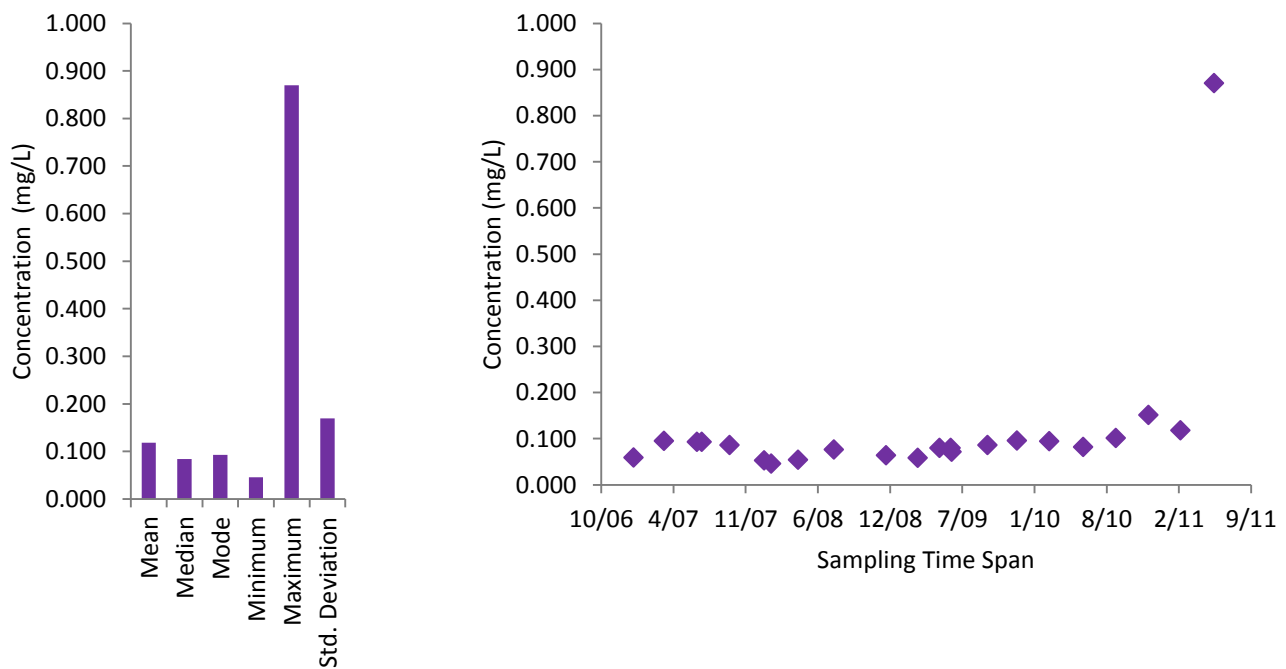
PPL Brunner Island, LLC

PA0008281

### 9.5.3 Boron

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median boron concentration of .084 mg/L. The Department's PENTOXSD model calculates a boron limit of 19.644 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent boron concentration is approximately 0.4 % of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-6. Outfall 004 Boron Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

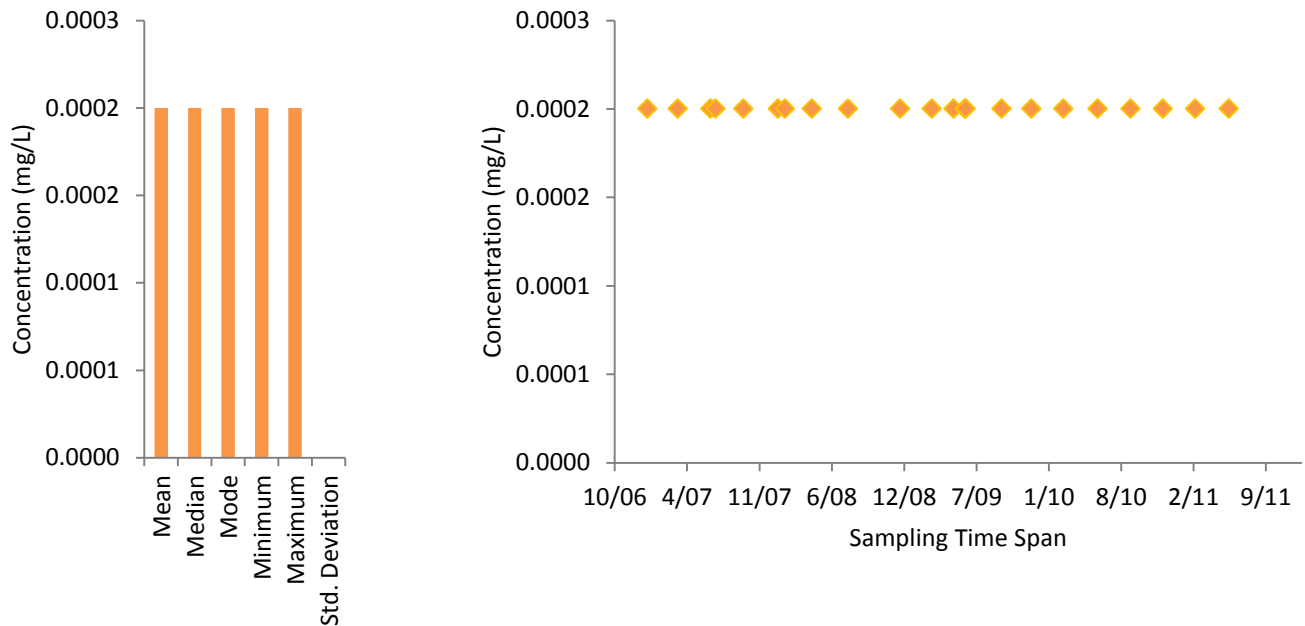
PPL Brunner Island, LLC

PA0008281

### 9.5.4 Cadmium

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median cadmium concentration of 0.0002 mg/L. The Department's PENTOXSD model calculates a cadmium limit of 0.005 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent cadmium concentration is approximately 4% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-7. Outfall 004 Cadmium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

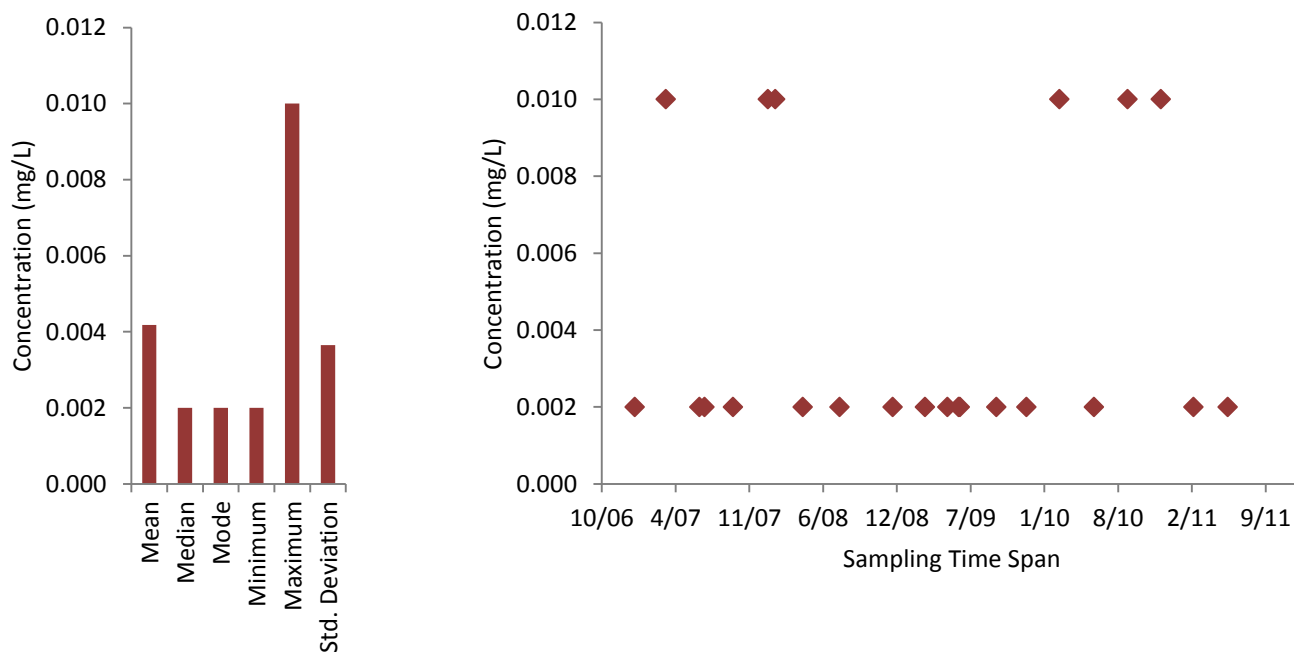
PPL Brunner Island, LLC

PA0008281

### 9.5.5 Chromium

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median total chromium concentration of 0.002 mg/L. The Department's PENTOXSD model does not recognize total chromium as an input, but rather splits the chromium into trivalent chromium ( $\text{Cr}^{3+}$ ) and hexavalent chromium ( $\text{Cr}^{6+}$ ). For the trivalent chromium parameter, the PENTOXSD model calculated a limit is 1.748 mg/L (Chronic Fish Criteria), and for the hexavalent chromium parameter, the PENTOXSD model calculated a limit is 0.039 mg/L (Acute Fish Criteria), both at  $Q_{7-10}$  conditions. Since the median concentration for total chromium remains low compared to the trivalent chromium, but not the hexavalent chromium, and based on EPA's identification of hexavalent chromium as pollutant of concern in document no. EPA-821-R-09-008, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

Figure 9-8. Outfall 004 Chromium Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

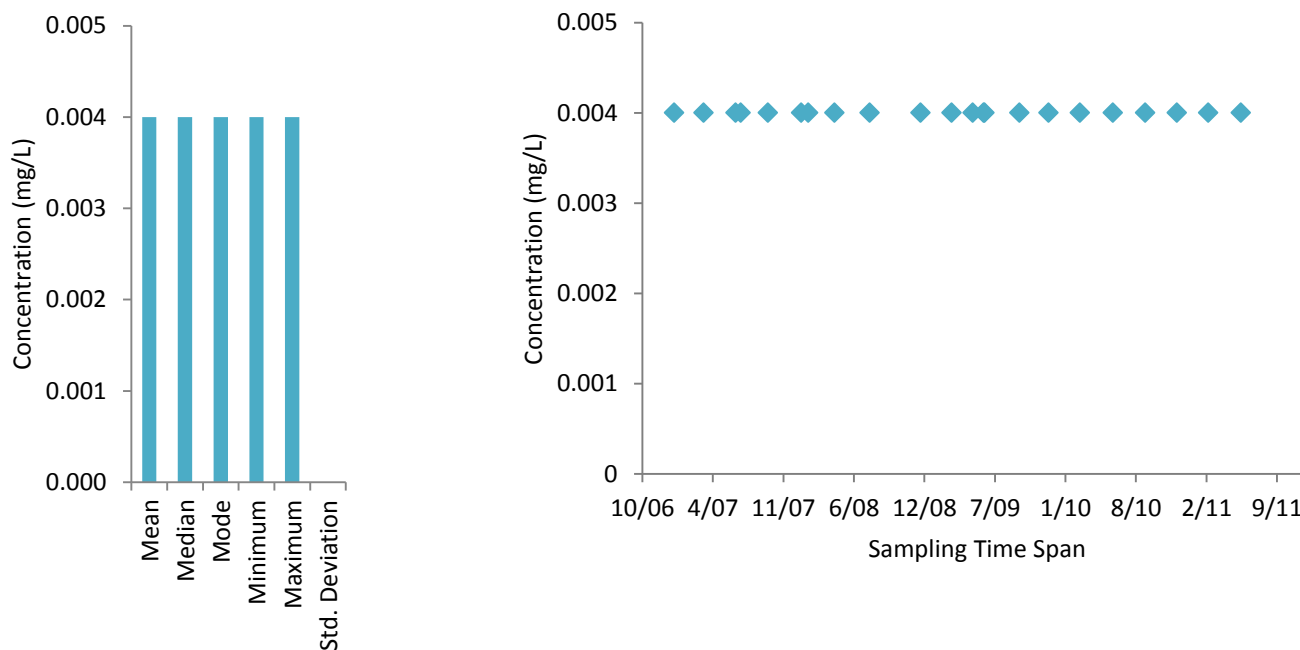
PPL Brunner Island, LLC

PA0008281

### 9.5.6 Copper

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median copper concentration of 0.004 mg/L. The Department's PENTOXSD model calculates a copper limit of 0.033 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent copper concentration is approximately 12% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-9. Outfall 004 Copper Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

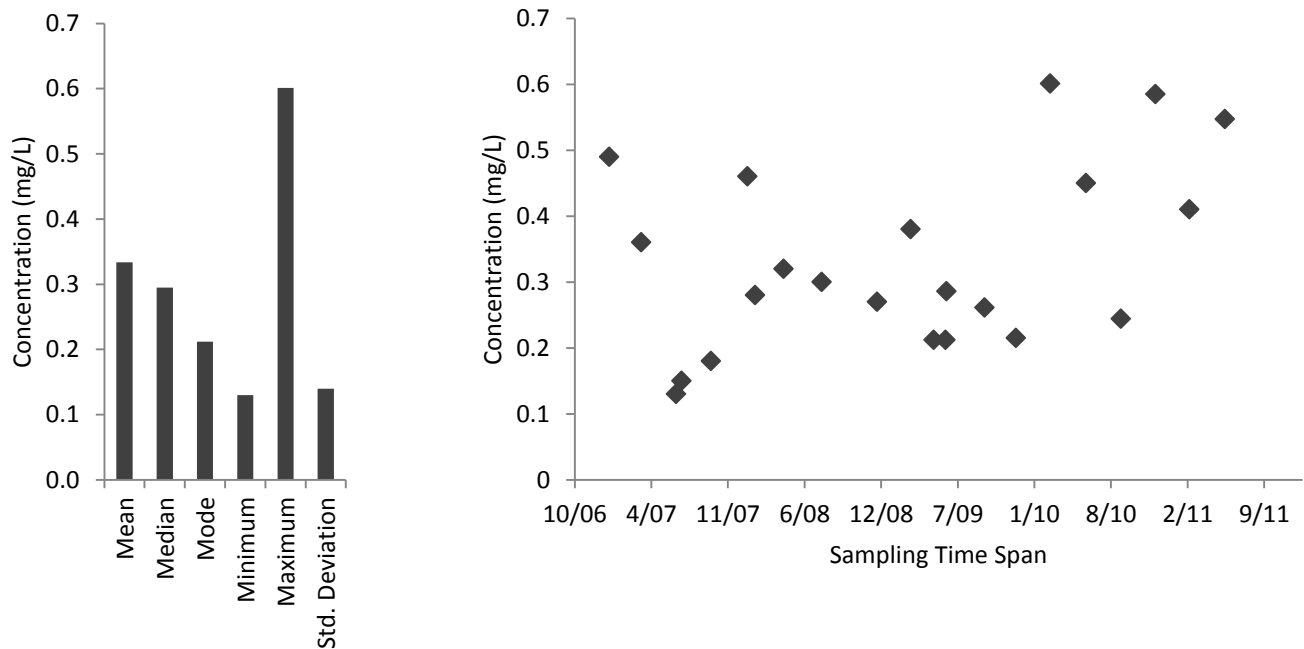
PPL Brunner Island, LLC

PA0008281

### 9.5.7 Iron

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median iron concentration of 0.295 mg/L. The Department's PENTOXSD model calculates an iron limit of 636.327 (Chronic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent iron concentration is approximately 0.05% of the PENTOXSD result. Based on the PENTOXSD results and the grab samples, the iron discharge concentration does not appear to be an aquatic health concern; therefore, it is recommended that iron be removed from the permit sampling requirements.

Figure 9-10. Outfall 004 Iron Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

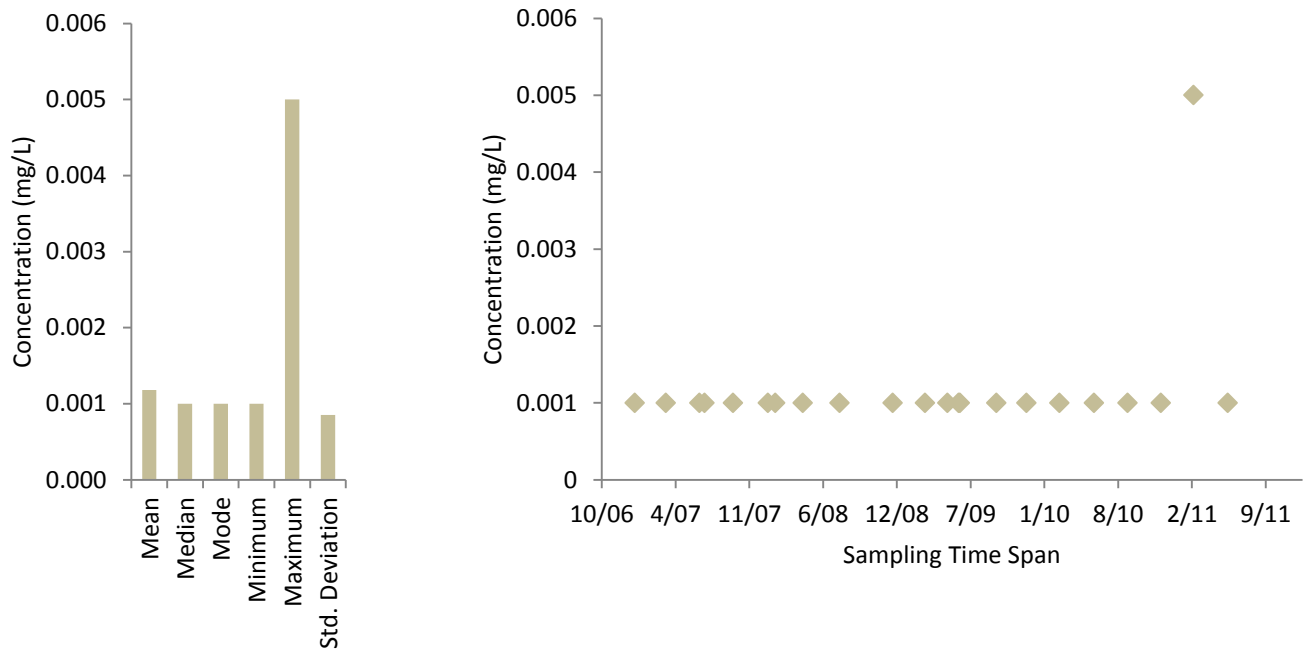
PPL Brunner Island, LLC

PA0008281

### 9.5.8 Lead

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median lead concentration of 0.001 mg/L. The Department's PENTOXSD model calculates a lead limit of 0.064 mg/L (Chronic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent lead concentration is approximately 1.5% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

Figure 9-11. Outfall 004 Lead Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

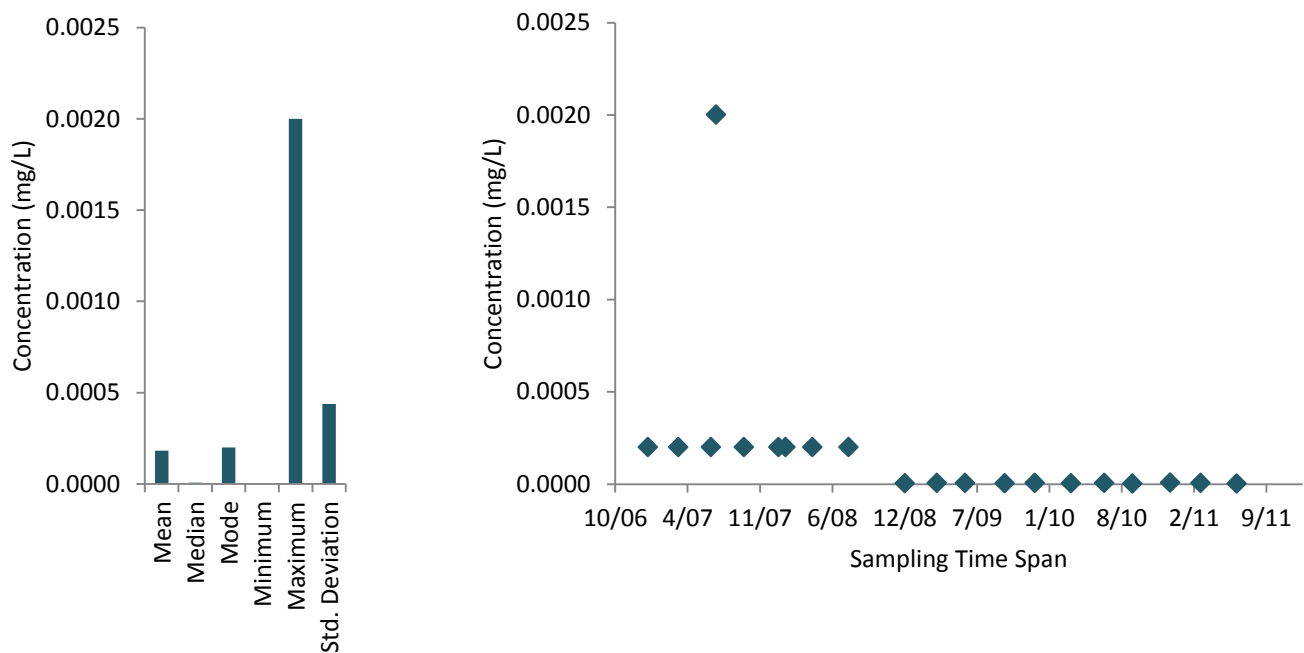
PPL Brunner Island, LLC

PA0008281

### 9.5.9 Mercury

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median mercury concentration of 0.00000685 mg/L. The Department's PENTOXSD model calculates a mercury limit of 0.001 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent mercury concentration is approximately 0.7% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-12. Outfall 004 Mercury Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

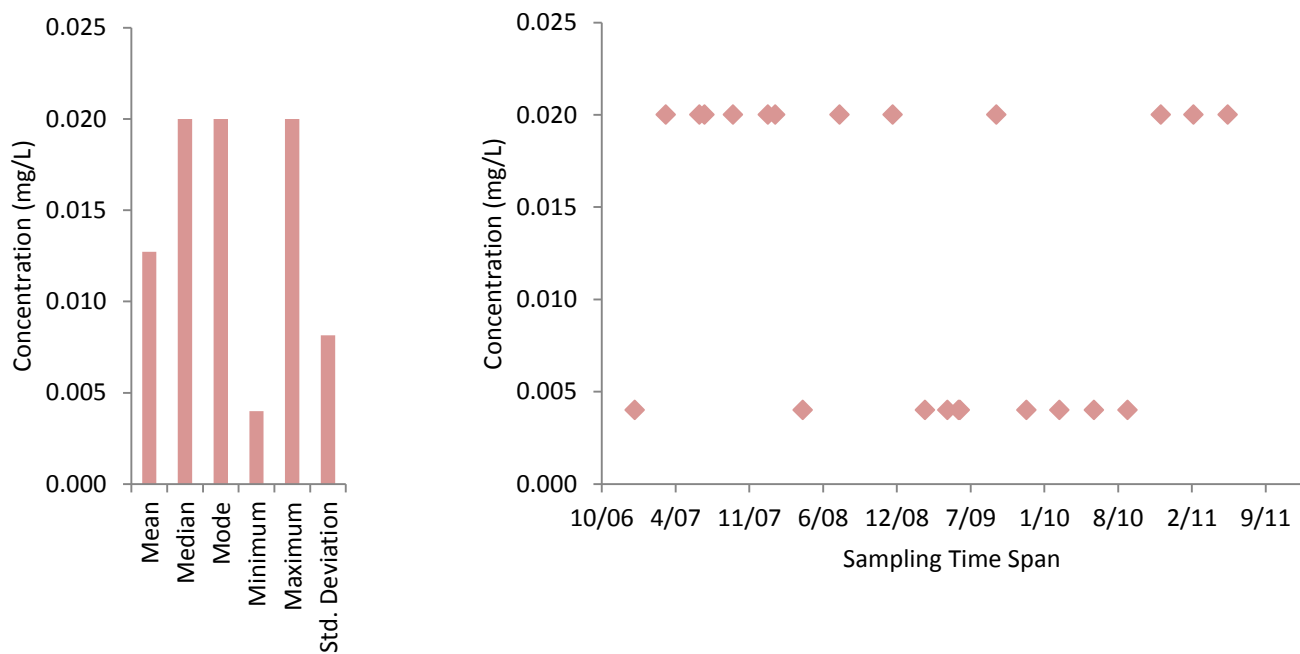
PPL Brunner Island, LLC

PA0008281

### 9.5.10 Molybdenum

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median molybdenum concentration of 0.020 mg/L. The Department's PENTOXSD model does not contain a criterion for molybdenum; however, the Department's technical staff in Central Office provided provisional molybdenum criteria of 0.210 ug/L (Human Health Criteria). This value when used in the PENTOXSD model, produces an effluent limit concentration of 4.260 mg/L. The sampling data indicates PPL Brunner Island, LLC's median effluent molybdenum concentration is approximately 0.5% of the PENTOXSD result. Since the median concentration remains low compared to the sample results and the current criteria is provisional, no limit is recommended. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-13. Outfall 004 Molybdenum Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

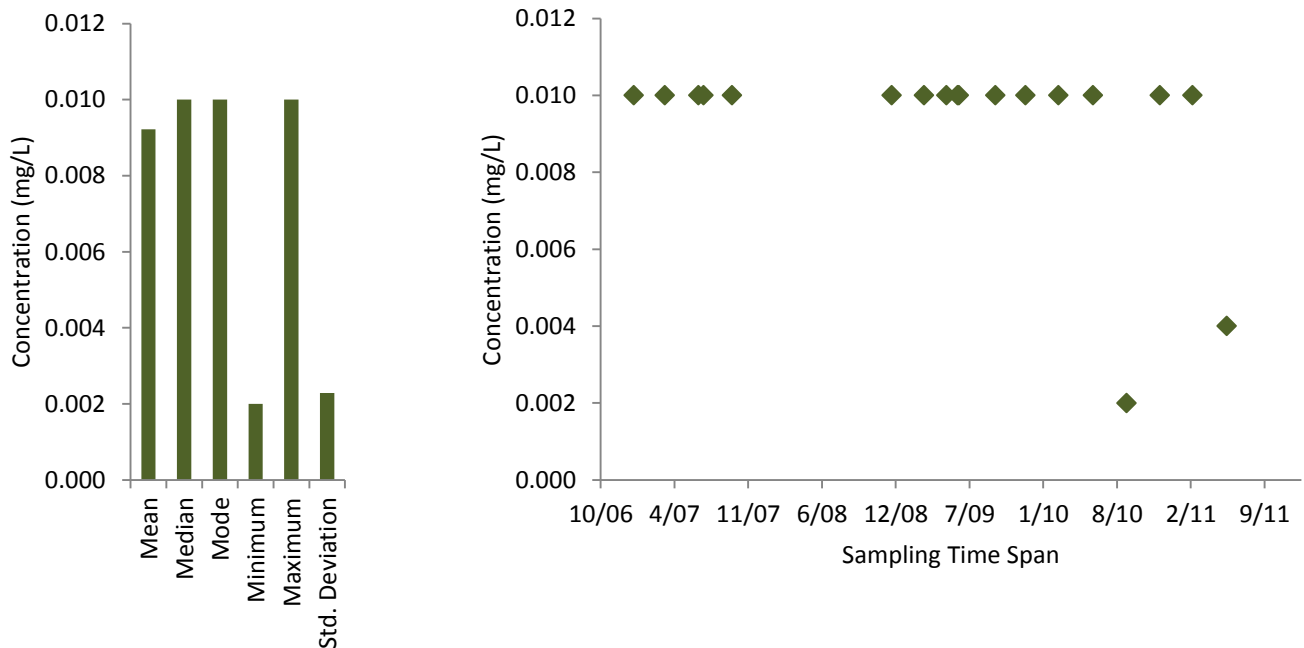
PPL Brunner Island, LLC

PA0008281

### 9.5.11 Nickel

PPL Brunner Island, LLC's grab sample results for the period from January 1<sup>st</sup>, 2007 to July 31<sup>st</sup>, 2011, shows a median nickel concentration of 0.010 mg/L. The Department's PENTOXSD model calculates a nickel limit of 1.058 mg/L (Chronic Fish Criteria) at  $Q_{7-10}$  conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent nickel concentration is approximately 0.9% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-14. Outfall 004 Nickel Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

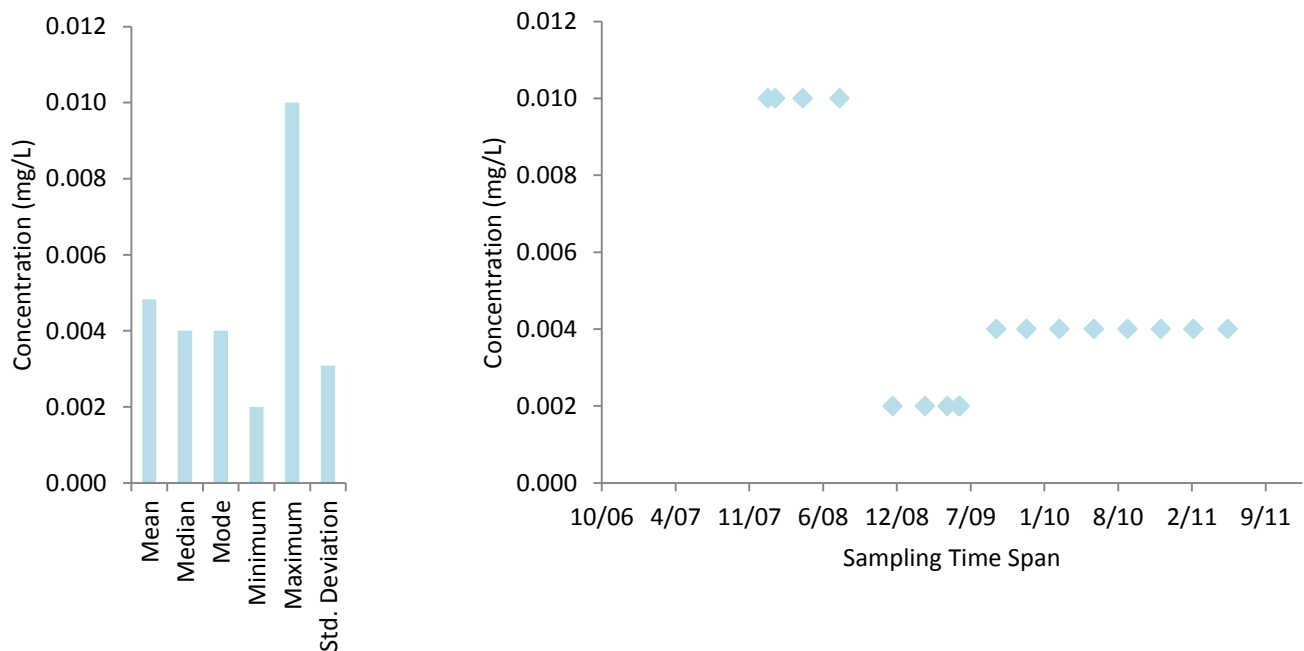
PPL Brunner Island, LLC

PA0008281

### 9.5.12 Selenium

PPL Brunner Island, LLC's grab sample results for the period from December 6<sup>th</sup>, 2008 to July 31<sup>st</sup>, 2011, shows a median selenium concentration of 0.004 mg/L. The Department's PENTOXSD model calculates a selenium limit of 0.101 mg/L (Chronic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent selenium concentration is approximately 4% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

**Figure 9-15. Outfall 004 Selenium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

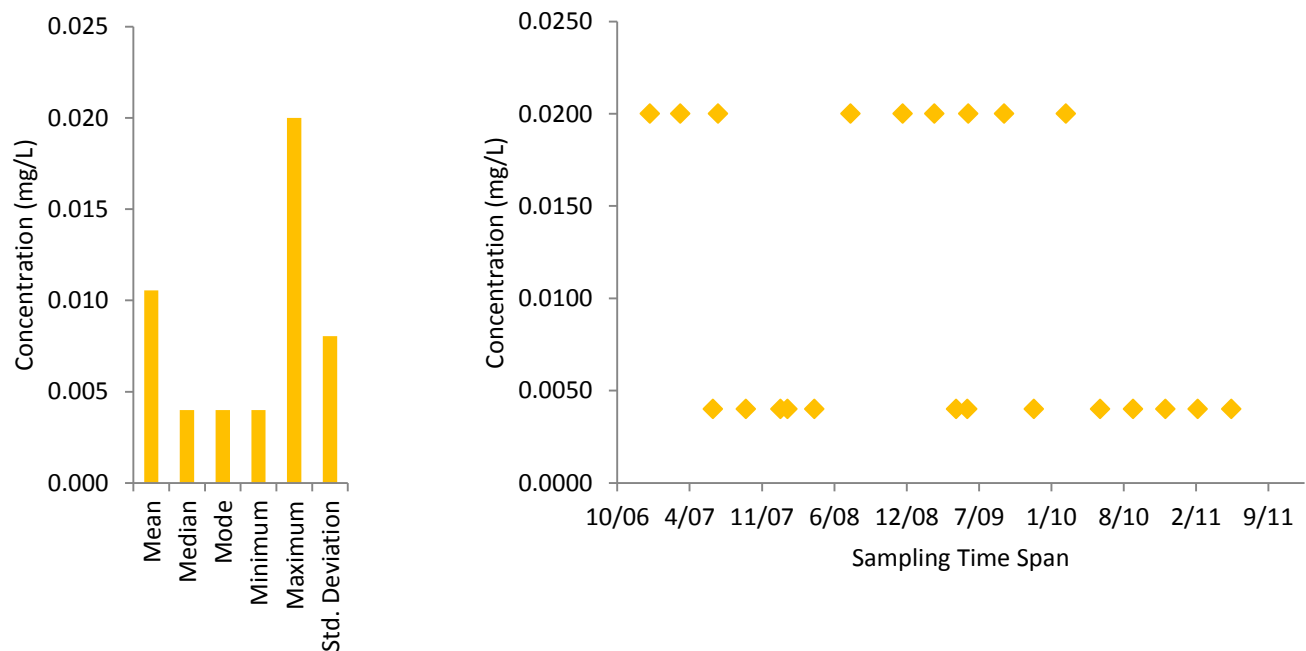
PPL Brunner Island, LLC

PA0008281

### 9.5.13 Zinc

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median zinc concentration of 0.004 mg/L. The Department's PENTOXSD model calculates a zinc limit of 0.290 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent zinc concentration is approximately 1% of the PENTOXSD result. Since PPL Brunner Island intends on closing out Ash Basin No. 6 and based on the grab sample results, it is recommended that PPL Brunner Island continue sampling on a quarterly basis using a grab sample type until the basin is closed.

Figure 9-16. Outfall 004 Zinc Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 9.6 Whole Effluent Toxicity Test (WET TEST)

PPL Brunner Island, LLC's NPDES permit requires the following for WET Test:

"The permittee shall conduct acute Whole Effluent Toxicity (WET) test for Outfall 004 effluent using the species *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum* on a semiannual basis until permit expiration. One series of tests shall be completed during the period of June 1 – August 30, and the second series of tests shall be completed during the period of September 1 – November 30. The WET test results shall be submitted to the Department within 45 days of test completion."

Table 9-4. WET Test Data				
Date	Species	Endpoint	Result (% Effluent)	Pass?
Nov 2011	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes
July 2011	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes
Oct 2010	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes
June 2010	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes
Sept 2009	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes
June 2009	<i>Ceriodaphnia dubia</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	48-hour LC <sub>50</sub>	> 100	Yes
	<i>Pimephales promelas</i>	96-hour LC <sub>50</sub>	> 100	Yes
	<i>Selenastrum capricornutum</i>	IC <sub>25</sub>	> 100	Yes

The WET Test data from 2009 through 2011 suggest that the effluent from outfall 004 does pose a toxicity concern to aquatic life. Based on the WET Test results, the WET Test requirement for outfall 004 is recommended for removal from the NPDES permit.

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 9.7 Recommended Limits

**Table 9-5. Outfall 004 Recommended Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	2/month	Grab
TSS	XXX	XXX	30	60	75	1/week	24-hr comp
Total Aluminum	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Arsenic	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Boron	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Cadmium	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Hexavalent Chromium	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Copper	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Iron	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Lead	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Mercury	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Molybdenum	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Nickel	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Selenium	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp
Total Zinc	XXX	XXX	XXX	M&R	XXX	1/quarter	24-hr comp

## **Water Quality Protection Report**

PPL Brunner Island, LLC

PA0008281

---

### **10. Outfall 005- Equalization Basin**

This outfall, according to the PPL Brunner Island, LLC's permit application, has been filled with concrete; therefore, redirecting the wastewater to Ash Basin No. 6, which discharges through outfall 004. Additionally, the DMR data from January 2007 through November 2011 shows no discharge from this outfall. Therefore, it is recommended for removal from the NPDES permit.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 11. Outfall 006 Groundwater Discharge

Outfall 006 is a spring discharge that flows to Hartman Run. The spring flow originates near retired Ash Basin No. 1 and No. 3. The current monitoring requirements for this outfall are show below.

**Table 11-1. Outfall 006 Existing Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
pH (S.U.)	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Aluminum	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Arsenic	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Boron	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Cadmium	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Chromium	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Copper	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Iron	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Lead	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Mercury	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Molybdenum	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Nickel	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Selenium	XXX	XXX	XXX	Report	XXX	1/year	Grab
Total Zinc	XXX	XXX	XXX	Report	XXX	1/year	Grab



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The current NPDES permit requires that PPL Brunner Island monitor the discharge once per year. The DMR data below shows that from 2007 through 2011, the discharge is generally unremarkable in that concentrations do not appear to have large fluctuations. However, it is recommended that PPL Brunner Island continue to monitor and report the discharge on an annual basis using a grab sample type.

**Table 11-2. Jan 2007 – July 2011 Sampling Results**

Parameter	pH	Tot. Al	Tot. As	Tot. B	Tot. Cd	Tot. Cr	Tot. Cu
Concentration	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2007	7.31	0.258	0.0010	0.172	0.0002	0.000	0.004
2008	7.50	0.100	0.0002	0.161	0.0002	0.010	0.004
2009	7.55	0.164	0.0002	0.238	0.0002	0.002	0.004
2010	7.70	0.187	0.0004	0.388	0.0002	0.010	0.004
2011	7.60	0.162	0.0004	0.430	0.0002	0.002	0.004

**Table 11-3. Jan 2007 – July 2011 Sampling Results**

Parameter	Tot. Fe	Tot. Pb	Tot. Hg	Tot. Mo	Tot. Ni	Tot. Se	Tot. Zn
Concentration	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2007	0.440	0.001	0.000002	0.020	0.002		0.020
2008	0.100	0.001	0.000002	0.004	0.002		0.020
2009	0.218	0.001	0.000008	0.004	0.002	0.020	0.020
2010	0.411	0.005	0.000007	0.004	0.010	0.026	0.004
2011	0.391	0.005	0.000009	0.020	0.004	0.035	0.020

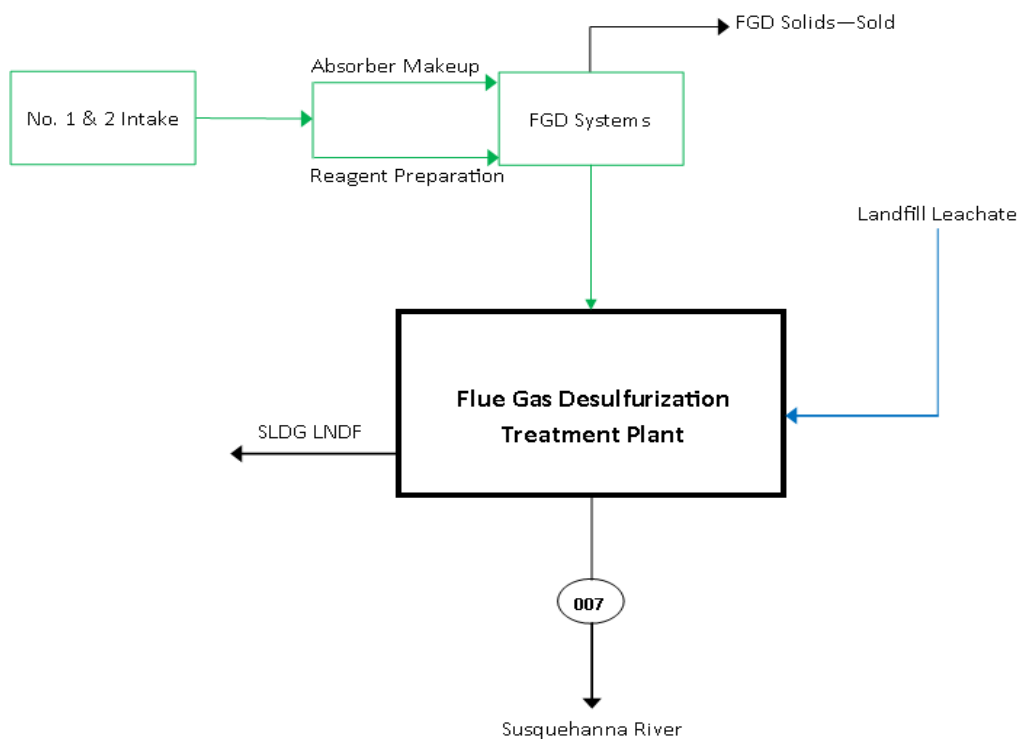
## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 12. Outfall 007- Flue Gas Desulfurization

The FGD IWTP receives wastewater and storm water from several sources within the PPL BISES site. Based on the Department's Water Quality Management permit, 6706201, issued on September 24, 2008, the hydraulic capacity of the FGD IWTP is 0.520 MGD. The PPL Brunner Island, LLC NPDES renewal application dated, March 18, 2011 provides a maximum day flow of 0.260 MGD and a monthly average flow of 0.170 MGD. **Figure 12-1. Wastewater sources to the FGD wastewater treatment system.**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

**Table 12-1. Schematic Abbreviations FGD**

SLDG LNDF	Sludge Landfill
-----------	-----------------

### 12.1 FGD Wastewater Background

Flue gas desulfurization wastewater generated at the Brunner Island site is the result of lime slurry, produced by mixing raw water from the Susquehanna River with lime, sprayed in the air scrubber units to remove  $\text{SO}_2$ . The slurry is then collected at the bottom of each scrubber. The spraying of the lime solution,  $\text{Ca}(\text{OH})_2$ , reacts with the  $\text{SO}_2$  to form calcium sulfite,  $\text{CaSO}_3$ .<sup>[1]</sup> The calcium sulfite when oxidized with air, turns into calcium sulfate,  $\text{CaSO}_4$ , or gypsum.<sup>[1]</sup> On the Brunner Island site, gypsum is produced and stored until the material is transported to processors.

The FGD wastewaters generally contain elevated levels of metals, such as arsenic, chloride, mercury and selenium, and TDS, TSS and nitrogen compounds as identified in the U.S. EPA, October 2009, *Steam Electric Power Generating Point Source Category: Final Detailed Study Report* (EPA-821-R-09-008) or the 'Final Report'. The grab sample results for the Brunner Island site are presented on the subsequent pages, along with monitoring recommendations.

### 12.2 FGD IWTP Operations

FGD wastewater entering the IWTP is treated as follows:

Equalization Tank (2) → Desaturation Tanks (2) → Coagulation-Precipitation Tanks (2) → Flocculation Tanks (2) → Sedimentation Tanks (2) → pH Control (pH) (2) → Filtration (2) → 007 to the Susquehanna River

Influent to the FGD IWTP enters two equalization tanks and from there wastewater is pumped to two desaturation tanks, which have an average detention time of 2.25 hours (1.5 hours at max flow). While the wastewater is in the desaturation tanks, lime slurry is added to adjust the pH, desaturate  $\text{CaSO}_4$  (gypsum) and precipitate heavy metals. Sludge from the clarifier/thickener tank is recycled into the desaturation units.

Wastewater then flows by gravity to the coagulation-precipitation units where ferric chloride and sodium sulfide is used to reduce heavy metals with an average reaction time of 45 minutes (30 mins at max flow). From the coagulation-precipitation tanks, wastewater flows to two DensaDeg clarifier/thickener tanks.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

Each clarifier/thickener unit has two compartments, reaction and settle. An anionic polymer is added to aid coagulation. Wasted sludge is sent to filter belt press units for dewatering, with the filtrate pumped to the equalization tank and dewatered sludge landfilled.

The clarified effluent then flows to two pH adjustment tanks with an average detention time of 2.25 hours (1.5 hours max flow). The pH is adjusted by the addition of hydrochloric acid.

Effluent exiting the blending tanks then flows by gravity to two effluent filters (64 ft<sup>2</sup>) with a designed average loading rate of 1.95 gpm/ft<sup>2</sup> (2.98 gpm/ft<sup>2</sup> at max flow). The filter backwash is collected in two additional tanks and then returned to the equalization tank.

The filtered effluent then flows to two final effluent tanks with an average detention time of 1.5 hours (1 hour at max flow). The final effluent is then pumped to outfall 007.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 12.3 Existing Limits

The current NPDES permit, permit cycle October 1<sup>st</sup>, 2006 to September 30, 2011, requires the following parameters be sampled for:

**Table 12-2. Outfall 007 Existing Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	1/week	Grab
TSS	XXX	XXX	30	100	100	1/week	24-hr comp
Total Aluminum	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Arsenic	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Boron	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Cadmium	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Chromium	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Copper	XXX	XXX	0.45	0.90	1.1	1/week	24-hr comp
Total Iron	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Lead	XXX	XXX	0.4	0.8	1.0	1/week	24-hr comp
Total Mercury	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Molybdenum	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Nickel	XXX	XXX	XXX	M&R	XXX	1/month	Grab

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

Total Selenium	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Total Zinc	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Chloride	XXX	XXX	XXX	M&R	XXX	1/month	Grab
Fluoride	XXX	XXX	XXX	M&R	XXX	1/month	Grab

### 12.4 pH

The effluent discharge pH is required to remain above 6 and below 9 standard units (S.U.) according to 25 Pa Code § 95.2(1)(i).

## Water Quality Protection Report

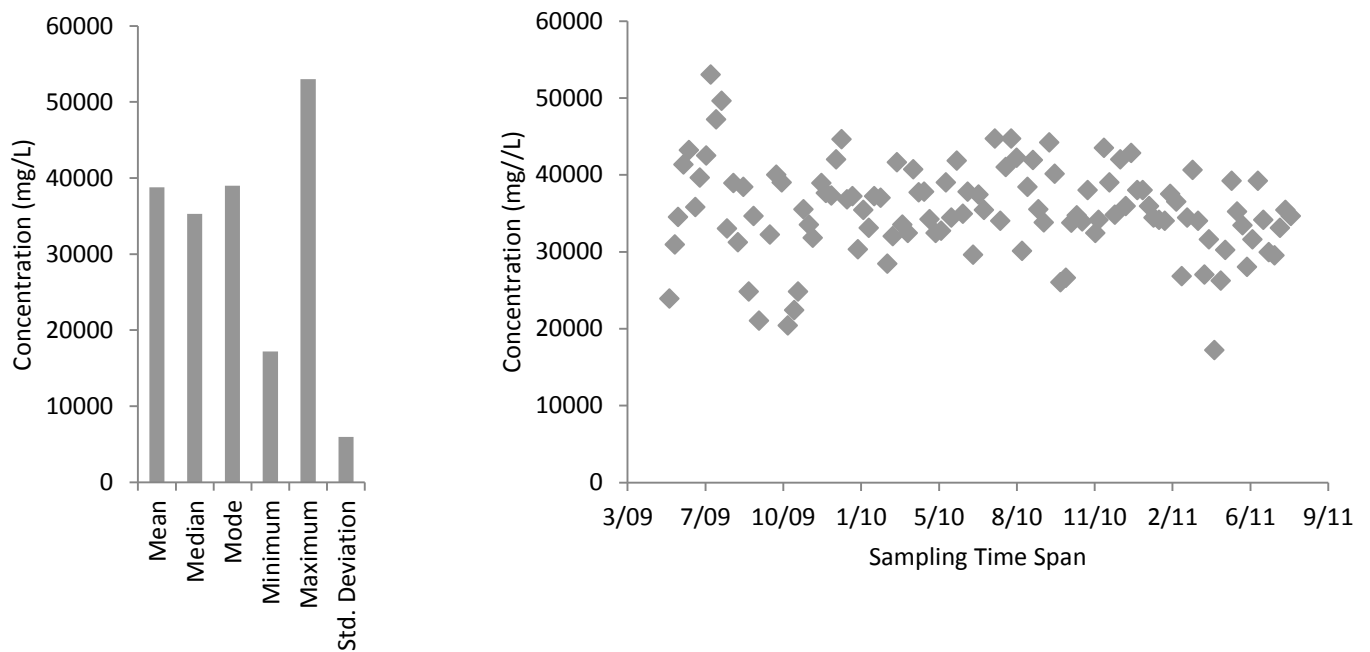
PPL Brunner Island, LLC

PA0008281

### 12.5 Total Dissolved Solids (TDS)

The sample results for the daily maximum TDS concentrations from the effluent at outfall 007 from May of 2009 to July of 2011, show the TDS concentration in the final effluent typically ranges between 30,000 to 40,000 mg/L. Based on a median concentration of 35,300 mg/L and a monthly average flow of 0.170 MGD, the Brunner Island site discharges through outfall 007, approximately 50,048 lbs/day of TDS ( $35,300 \text{ mg/L} * 0.170 \text{ MGD} * 8.34$ ). The scatter chart below shows the daily maximum TDS concentrations sampled for since May of 2009 to July of 2011. Adjacent to the scatter chart is basic descriptive statistics for the same sampling period.

**Figure 12-3. Outfall 007 TDS Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

Since the facility was authorized to discharge TDS prior to August 21, 2010, no limit is required at this time; however, 25 Pa Code § 95.10(b)(3)(g) states the following:

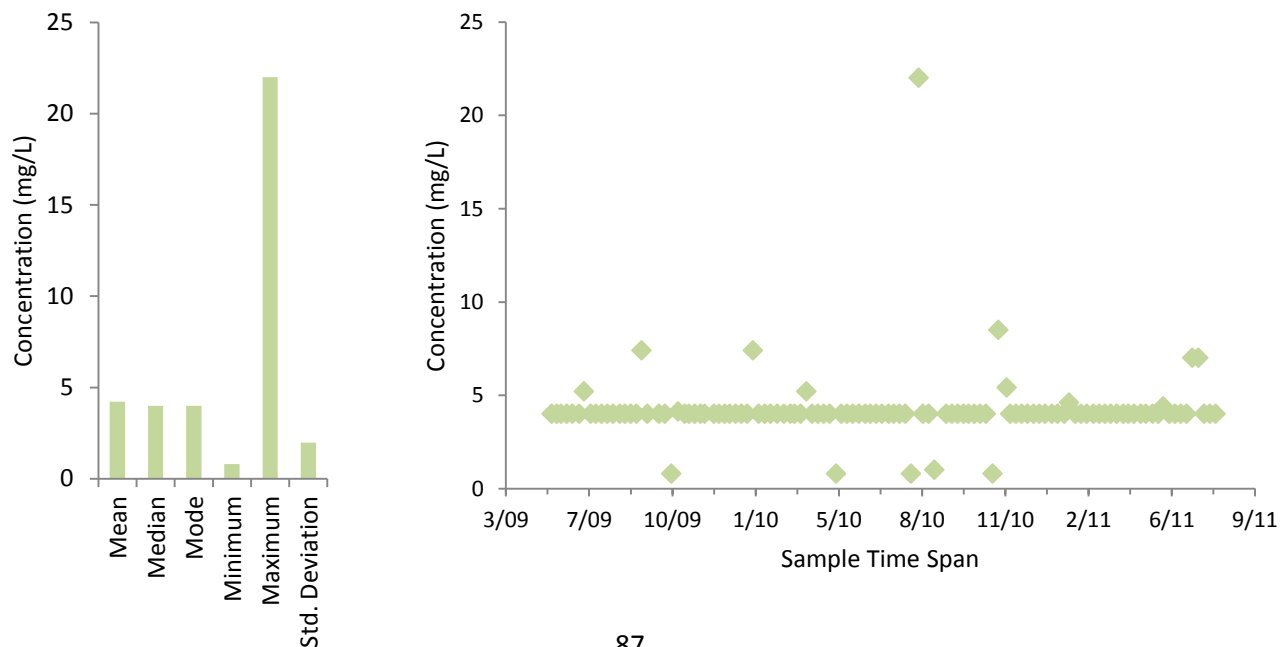
“Coal-fired steam generating units subject to effluent limitations in 40 CFR Part 423 (relating to steam electric power generating point source category), including TDS effluent limitations created by the EPA rulemaking on effluent limitations scheduled for completion by March 2014 (Docket No. EPA-HQ-OW-2009-0829), must comply with subsection (c) by December 31, 2018, unless exempted b subsection (a).”

### 12.6 Total Suspended Solids (TSS)

The sample results for the daily maximum TSS concentrations from the effluent at outfall 007 suggest the TSS concentration has remained below the permitted daily maximum value of 100.0 mg/L.

There is not a water quality criterion for TSS. Since the wastewater source to the FGD treatment system can be defined as “low volume waste” (see 40 CFR § 423.11 for definition), best practicable control technology currently available (BPT) is applicable. Based on 40 CFR § 423.12(b)(3) & (b)(10), 30.0 mg/L as a monthly average limit and 100.0 mg/L as a daily maximum limit are recommended.

**Figure 12-4. Outfall 007 TSS Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

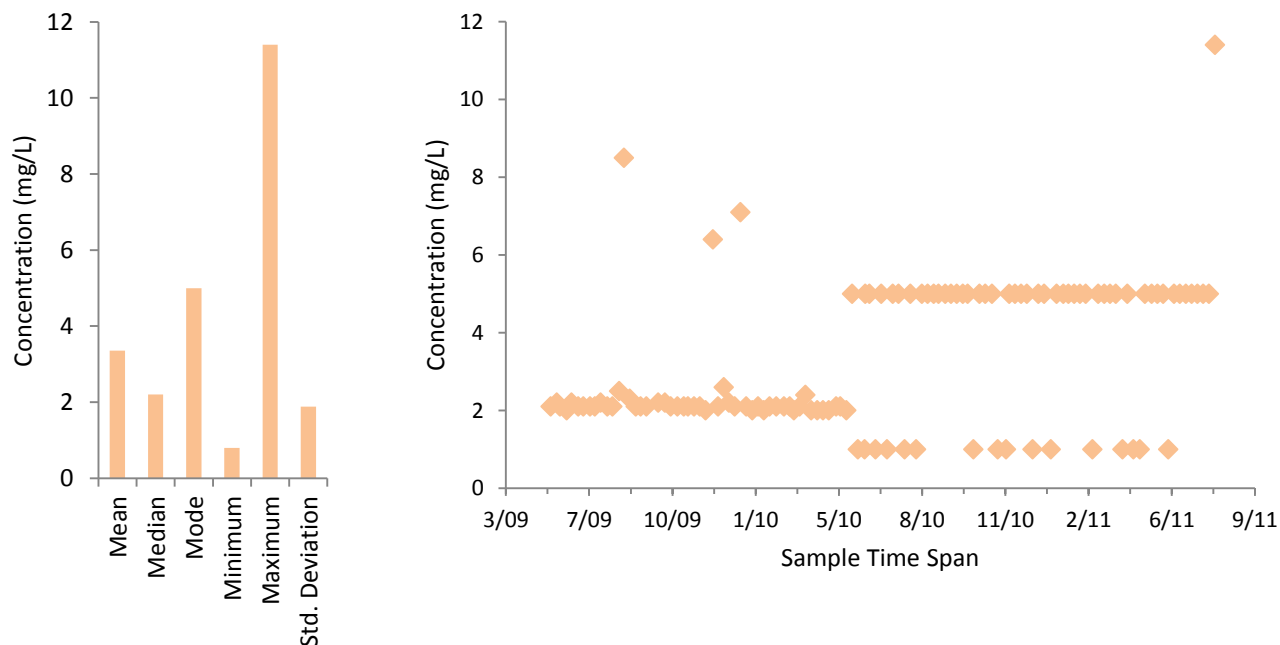
Additionally the previous permit established an instantaneous maximum of 100.0 mg/L or the same as the daily maximum; therefore, the limit will remain in the permit.

### 12.7 Oil & Grease

The graph below shows the sample results for the daily maximum oil & grease concentrations from the effluent at outfall 007. Oil & Grease has remained below the permitted daily maximum value of 20.0 mg/L.

An average monthly limit of 15.0 mg/L will be required based on the minimum level of effluent quality

**Figure 12-5. Outfall 007 O&G Concentration Descriptive Statistics & Scatter Plot**



attainable by best practicable control technology (BPT) as defined in 40 CFR 423.12(b)(3). The previous permit established a daily maximum limit of 20.0 mg/L and an instantaneous maximum limit of 30.0 mg/L, these values are based on the Department standard multipliers for IW sites found in guidance document no. 362-0400-001 10/1/1997. Therefore, the previously established daily maximum value and instantaneous maximum value will remain in the permit.

## Water Quality Protection Report

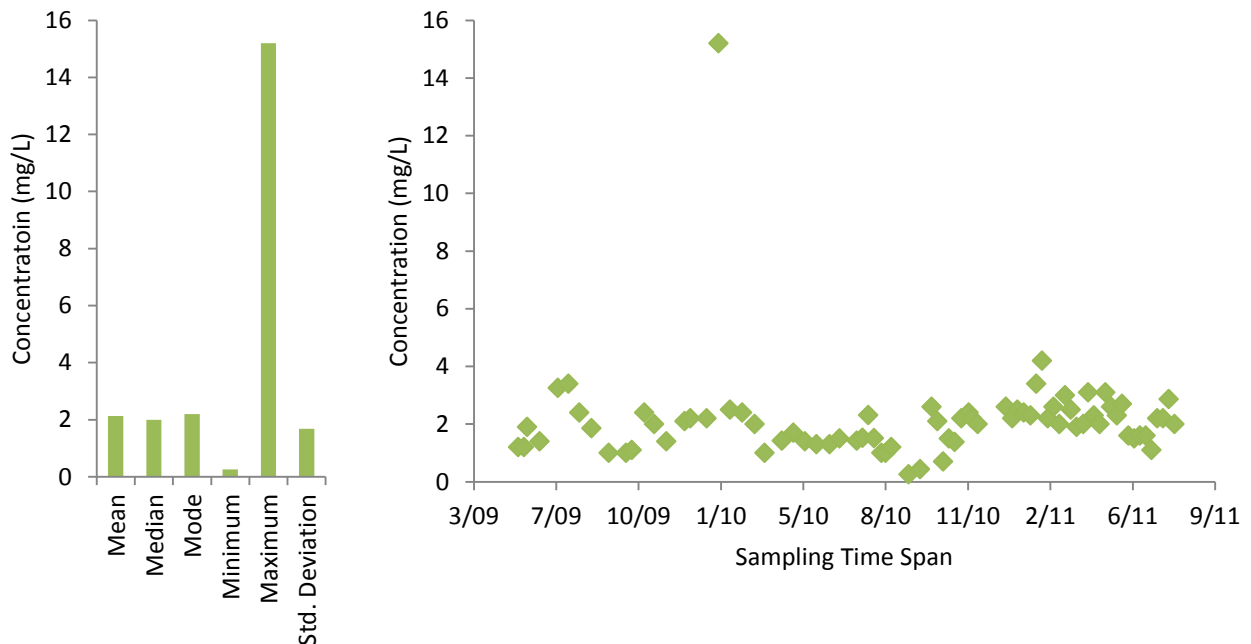
PPL Brunner Island, LLC

PA0008281

### 12.8 Total Nitrogen

As a result of the air emissions control system, the Brunner Island FGD treatment receives wastewater with elevated levels of TN as compared to the influent raw water concentration. Based on EPA's October 2009 report on steam electric generators, this is a typical characteristic of the effluent from FGD systems that do not use biological treatment. PPL Brunner Island, LLC entered into an agreement with the Pennsylvania Infrastructure Investment Authority on October 4, 2011 to purchase TN and TP credits to meet net zero annual Bay loading established in their previous NPDES permit. No limit for TN is recommended at this time; however, it is required that PPL Brunner Island, LLC continue to purchase TN credits to offset the discharged TN loading.

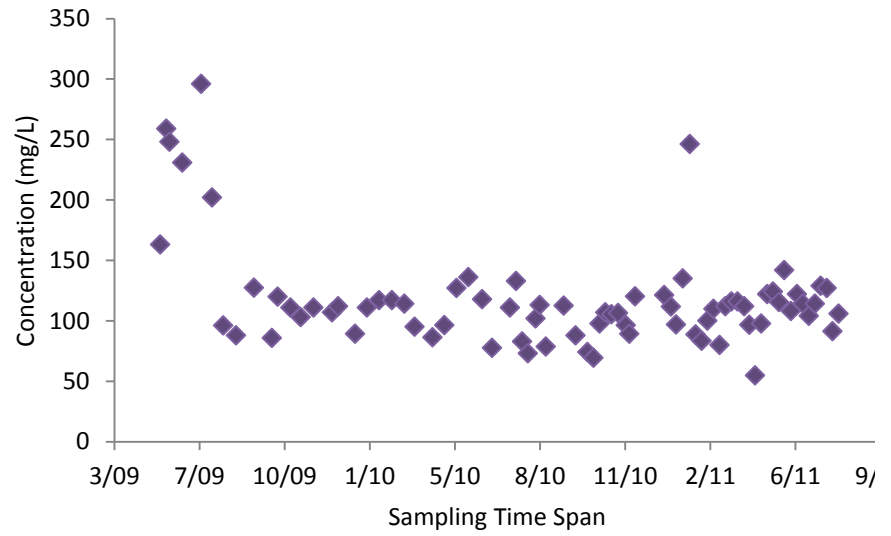
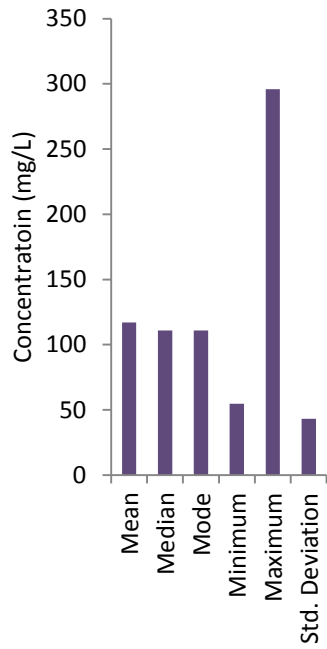
**Table 12-6. May 2009 to July 2011 Influent (top) & Effluent (next page) TN Concentrations**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 12.9 Metals Discharge Data

Provided on the subsequent pages are brief data summaries of each parameter sampled for, as well as accompanying bar graphs with descriptive statistics extracted from the discharge records reviewed from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011. Since the current NPDES permit was issued in 2006, the metal parameters have been sampled on monthly basis; however, a subsequent amendment to the permit occurred in April of 2007, which resulted in additional sampling requirements. Therefore, almost all of the metals evaluated had 27 data points with the exception of Total Copper and Total Lead, which have a weekly requirement or 112 data points at the time of the NPDES review.

The table below provides the annual range of daily average effluent flows for Outfall 007 reported since the beginning of 2007 through the partial year of 2011.

Table 12-3. Outfall 002 Flows		
Year	Range of Flow (MGD)	
	Min	Max
2007	n/a	n/a
2008	n/a	n/a
2009	0	0.218
2010	0	0.312
2011	0	0.318

Given the variability of the influent wastewater flow and potential concentration fluctuations, composite sampling is recommended. See Attachment B for PENTOXSD results.

## Water Quality Protection Report

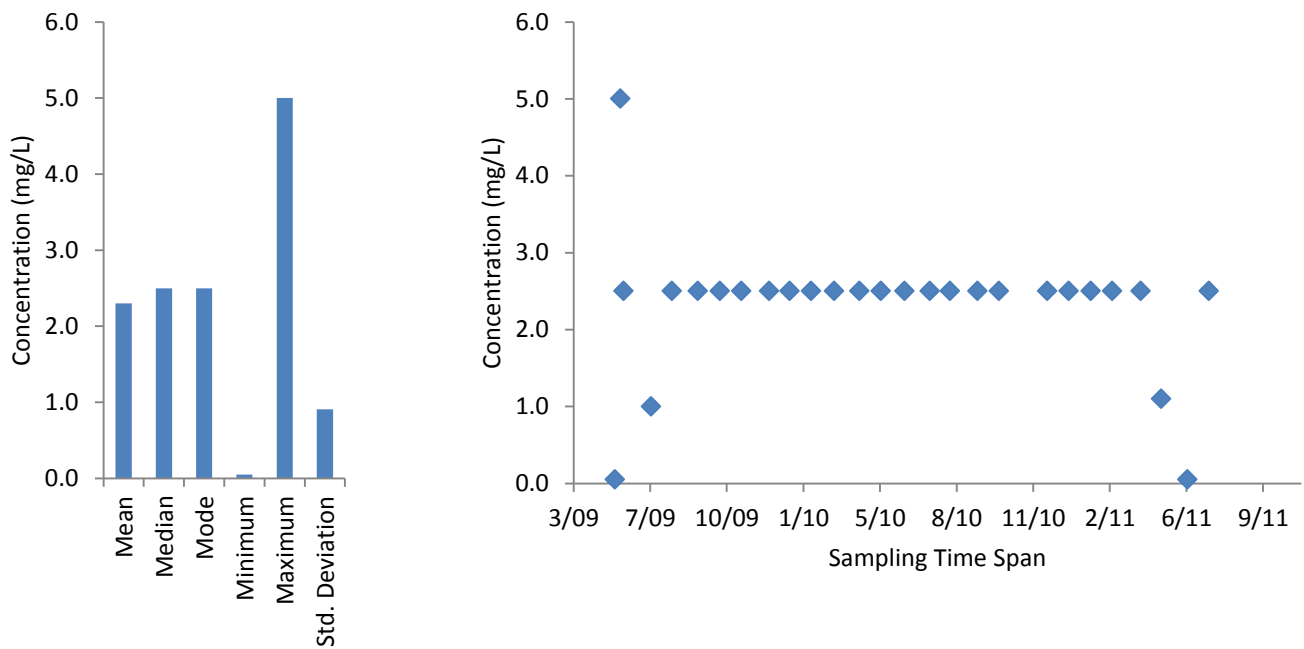
PPL Brunner Island, LLC

PA0008281

### 12.9.1 Aluminum

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median aluminum concentration of 2.5 mg/L. The Department's PENTOXSD model calculates an aluminum limit of 10.987 mg/L (Acute Fish Criterion) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island, LLC's median effluent aluminum concentration is approximately 23% of the PENTOXSD result, the sample results are based on grab samples, which may not fully characterize the aluminum concentration in the effluent. To confirm that the aluminum discharge concentration does not pose a threat to aquatic life and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type.

**Figure 12-7. Outfall 007 Aluminum Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

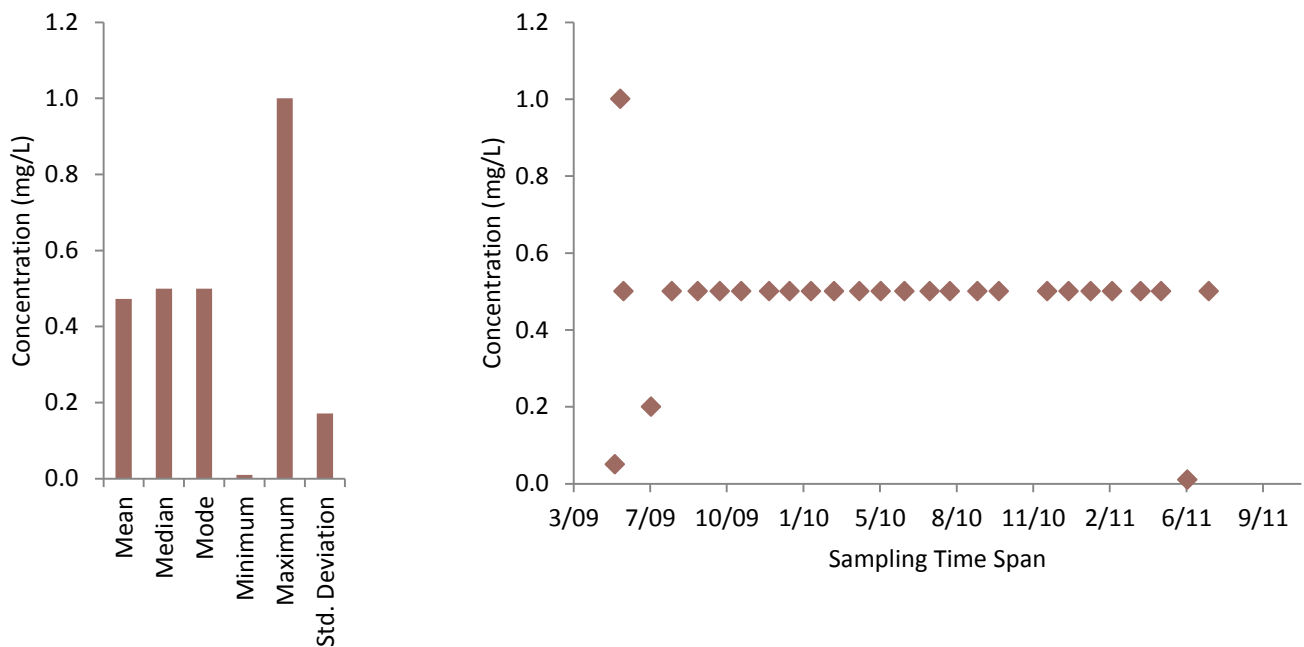
PPL Brunner Island, LLC

PA0008281

### 12.9.2 Antimony

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median antimony concentration of 0.50 mg/L. The Department's PENTOXSD model calculates an antimony limit of 0.853 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent antimony concentration is approximately 59% of the PENTOXSD result. The grab sample results show concentrations approaching the PENTOXSD calculated limit; therefore, the PENTOXSD calculated limit is recommended. Per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling on a weekly basis using a 24-hour composite sample type.

**Figure 12-8. Outfall 007 Antimony Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

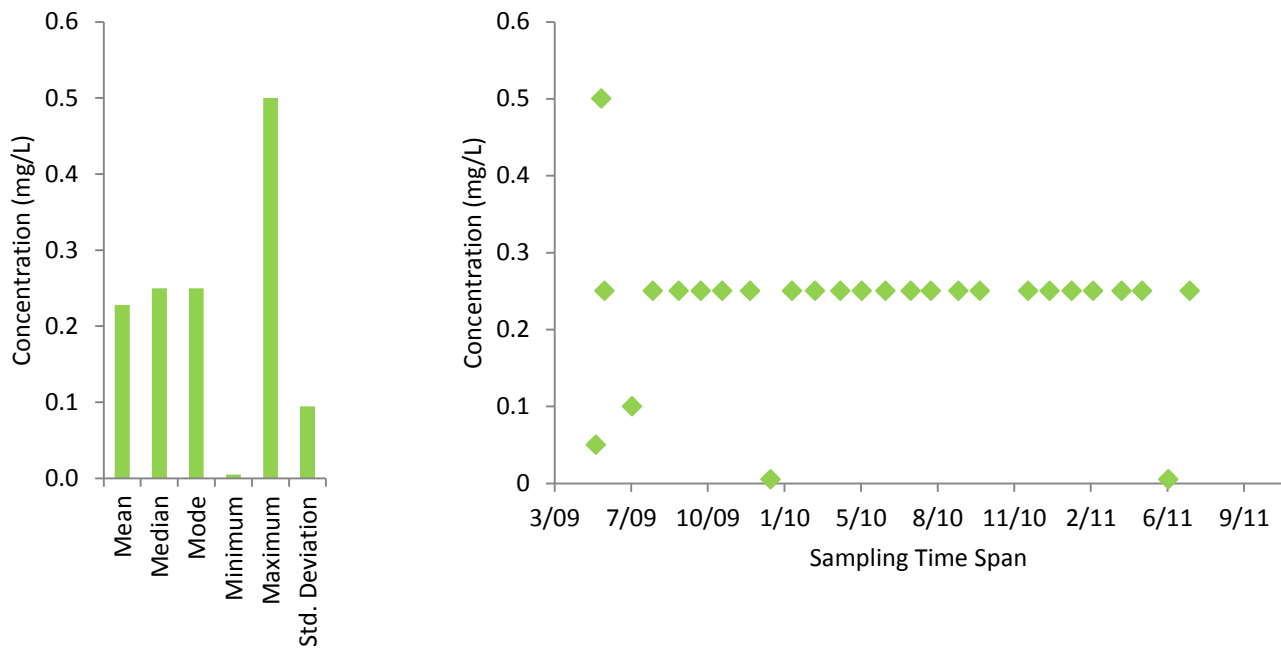
PPL Brunner Island, LLC

PA0008281

### 12.9.3 Arsenic

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median arsenic concentration of 0.25 mg/L. The Department's PENTOXSD model calculates an arsenic limit of 1.524 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. Although the sampling data indicates PPL Brunner Island, LLC's median effluent arsenic concentration is approximately 16% of the PENTOXSD result, the sample results are based on grab samples, which may not fully characterize the arsenic concentration in the effluent. To confirm arsenic is not a human health concern, PPL Brunner Island, LLC should perform sampling for an additional permit cycle. Per the Department's NPDES guidance document, no. 362-0400-001 (10/97), a 24-hour composite sample type is also recommended. Therefore, no limit is recommended; however, PPL Brunner Island, LLC should continue monitoring and reporting arsenic concentrations for Outfall 007.

**Figure 12-9. Outfall 007 Arsenic Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

PPL Brunner Island, LLC

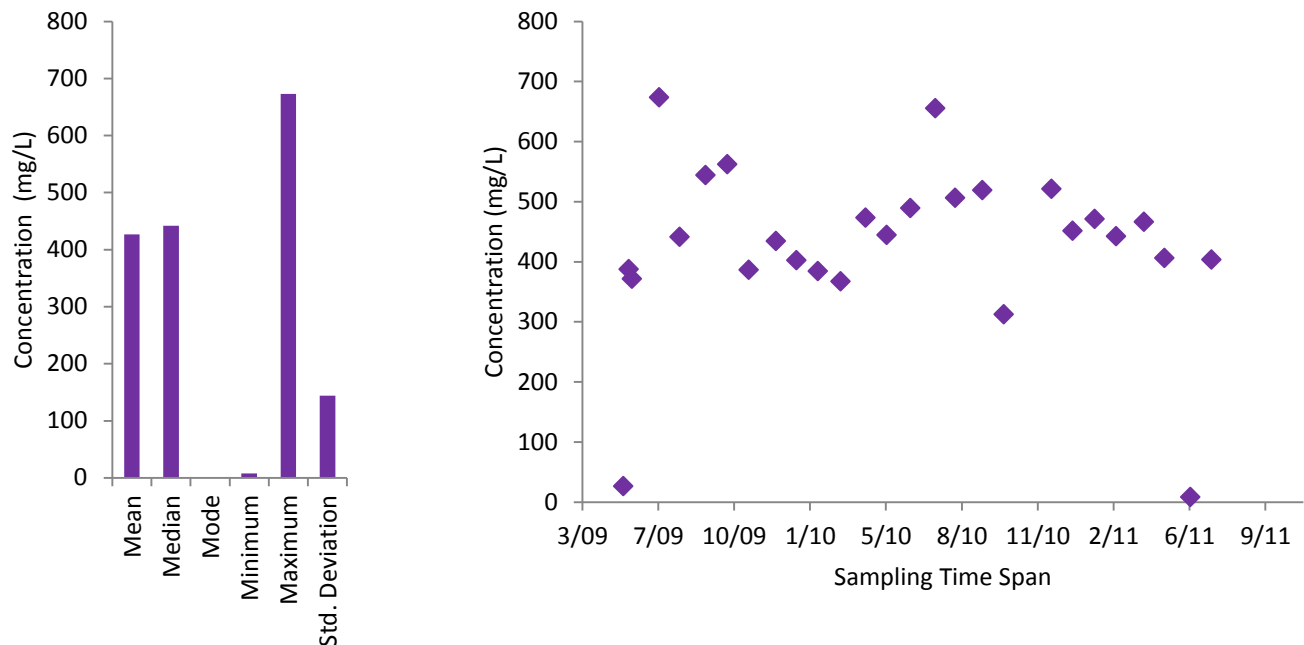
PA0008281

### 12.9.4 Boron

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median boron concentration of 442 mg/L. The Department's PENTOXSD model calculates a boron limit of 118.660 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent boron concentration is approximately 374 % of the PENTOXSD result.

Since the grab samples indicate relatively high concentrations of Boron as compared to the PENTOXSD results, an average monthly limit of 118 mg/L is recommended with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97). However, PPL Brunner Island will be given the option to perform a Toxicity Reduction Evaluation.

**Figure 12-10. Outfall 007 Boron Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

PPL Brunner Island, LLC

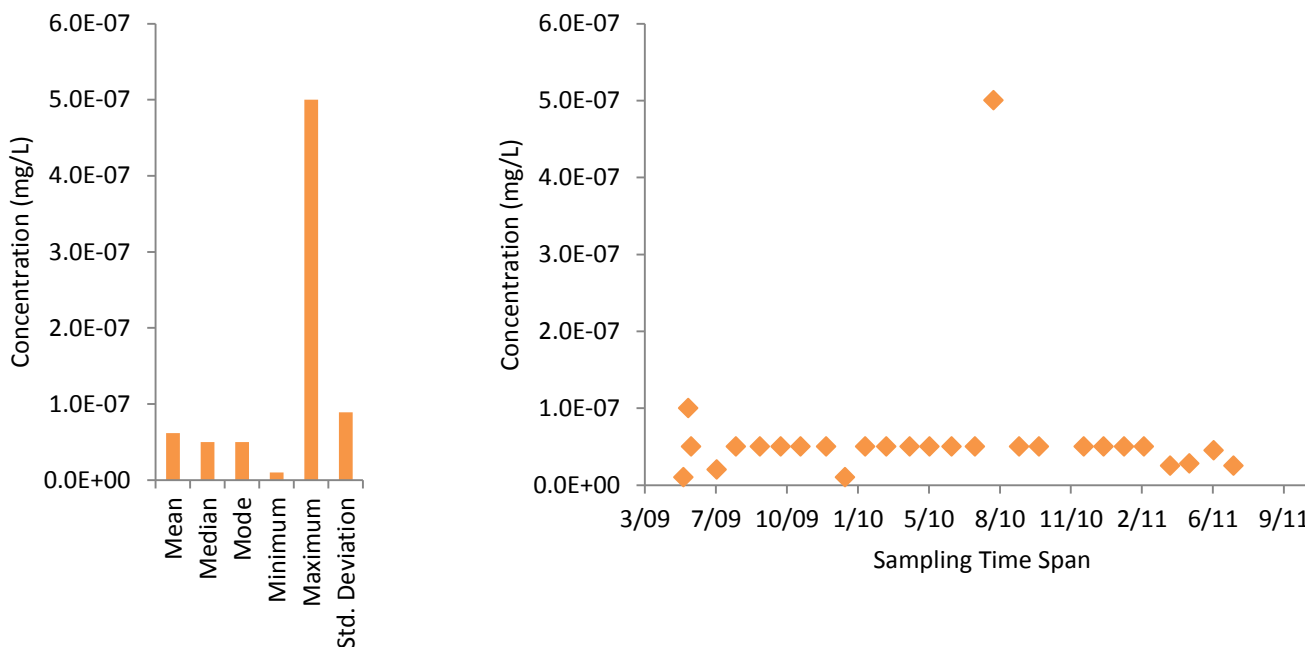
PA0008281

### 12.9.5 Cadmium

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median cadmium concentration of 0.0500 mg/L. The Department's PENTOXSD model calculates a cadmium limit of 0.031 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent cadmium concentration is approximately 161% of the PENTOXSD result.

Since the grab samples indicate relatively high concentrations of cadmium as compared to the PENTOXSD results, an average monthly limit of 0.031 mg/L is recommended with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97). However, PPL Brunner Island will be given the option to perform a Toxicity Reduction Evaluation.

**Figure 12-11. Outfall 007 Cadmium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

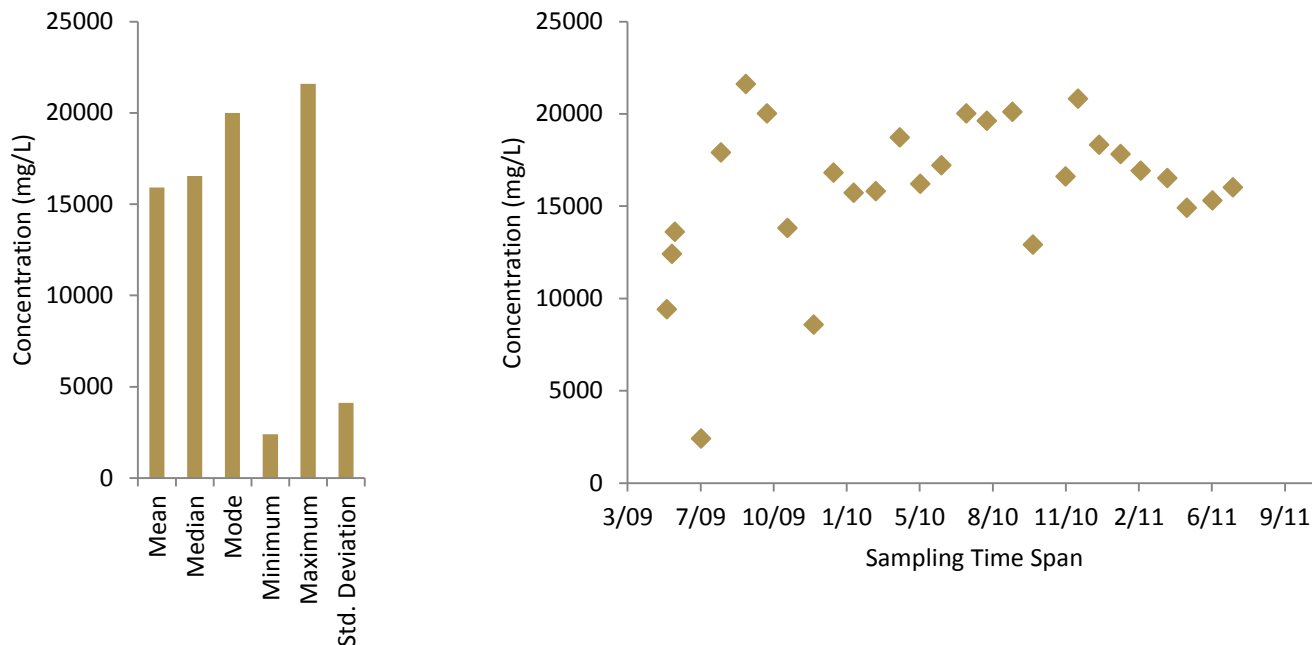
PPL Brunner Island, LLC

PA0008281

### 12.9.6 Chloride

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median chloride concentration of 16,550 mg/L. The Department's PENTOXSD model calculates a chloride limit of "input value" at Q<sub>7-10</sub> conditions, which suggest that no limit is required at this time. Additionally, chloride is a concern at the public water supply (PWS) intake and the discharge is not expected to impact the PWS intake. Effluent concentrations remain in the upper range of chloride concentrations identified in EPA's Final Report. Therefore, it is recommended that PPL Brunner Island, LLC continue to monitor and report chloride using a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-12. Outfall 007 Chloride Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

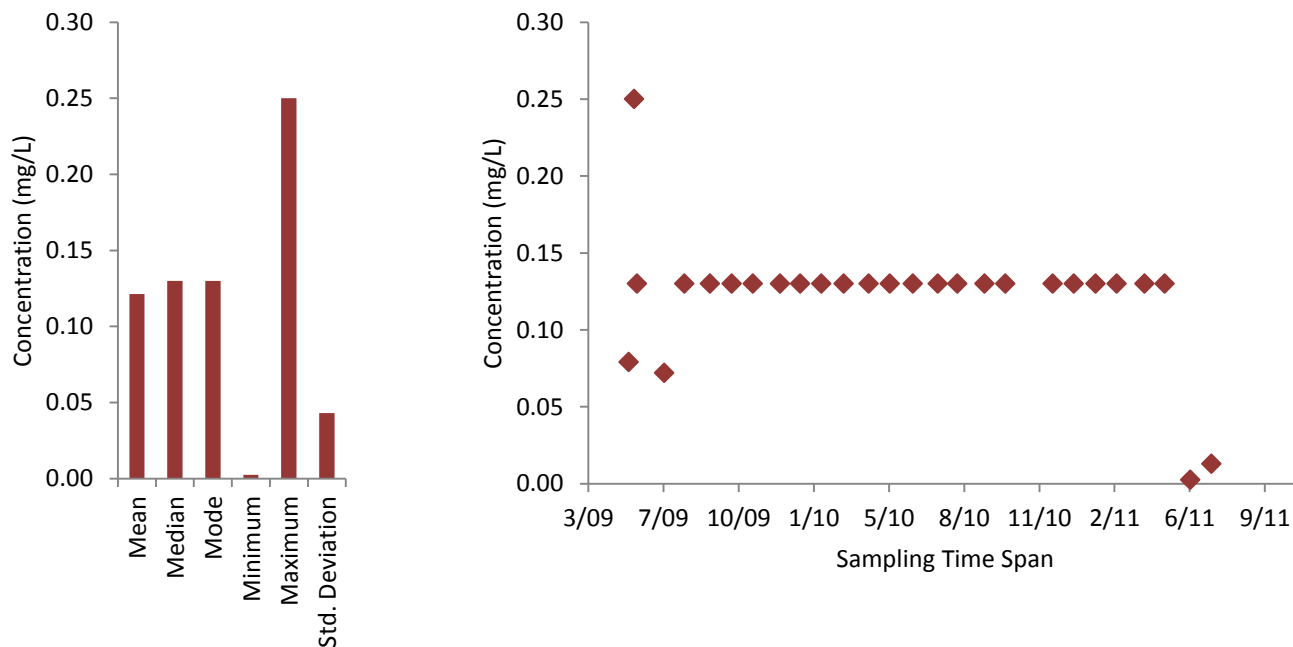
PPL Brunner Island, LLC

PA0008281

### 12.9.7 Chromium

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median total chromium concentration of 0.13 mg/L. The Department's PENTOXSD model does not recognize total chromium as an input, but rather splits the chromium into trivalent chromium ( $\text{Cr}^{3+}$ ) and hexavalent chromium ( $\text{Cr}^{6+}$ ). For the trivalent chromium parameter, the PENTOXSD calculated limit is 13.135 mg/L (Chronic Fish Criteria), and for the hexavalent chromium parameter, the PENTOXSD calculated limit is 0.238 mg/L (Acute Fish Criteria), both at  $Q_{7-10}$  conditions. Since the median concentration for total chromium remains low compared to the trivalent chromium, but not the hexavalent chromium, and based on EPA's identification of hexavalent chromium as pollutant of concern in their Final Report, it is recommended that PPL Brunner Island, LLC sample for hexavalent chromium with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-13. Outfall 007 Chromium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

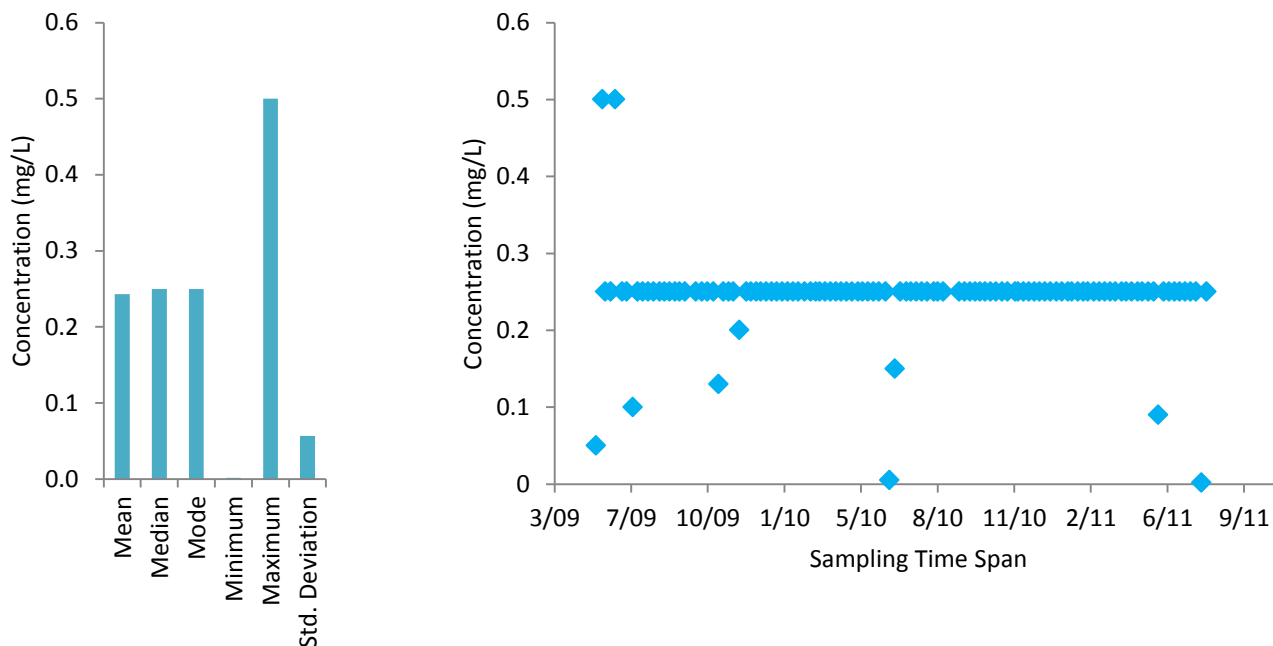
PPL Brunner Island, LLC

PA0008281

### 12.9.8 Copper

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median copper concentration of 0.25 mg/L. The Department's PENTOXSD model calculates a copper limit of 0.205 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent copper concentration is approximately 121.9% of the PENTOXSD result. Therefore, an average monthly effluent limit of 0.205 mg/L is recommended with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97). However, PPL Brunner Island will be given the option to perform a Toxicity Reduction Evaluation.

**Figure 12-14. Outfall 007 Copper Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

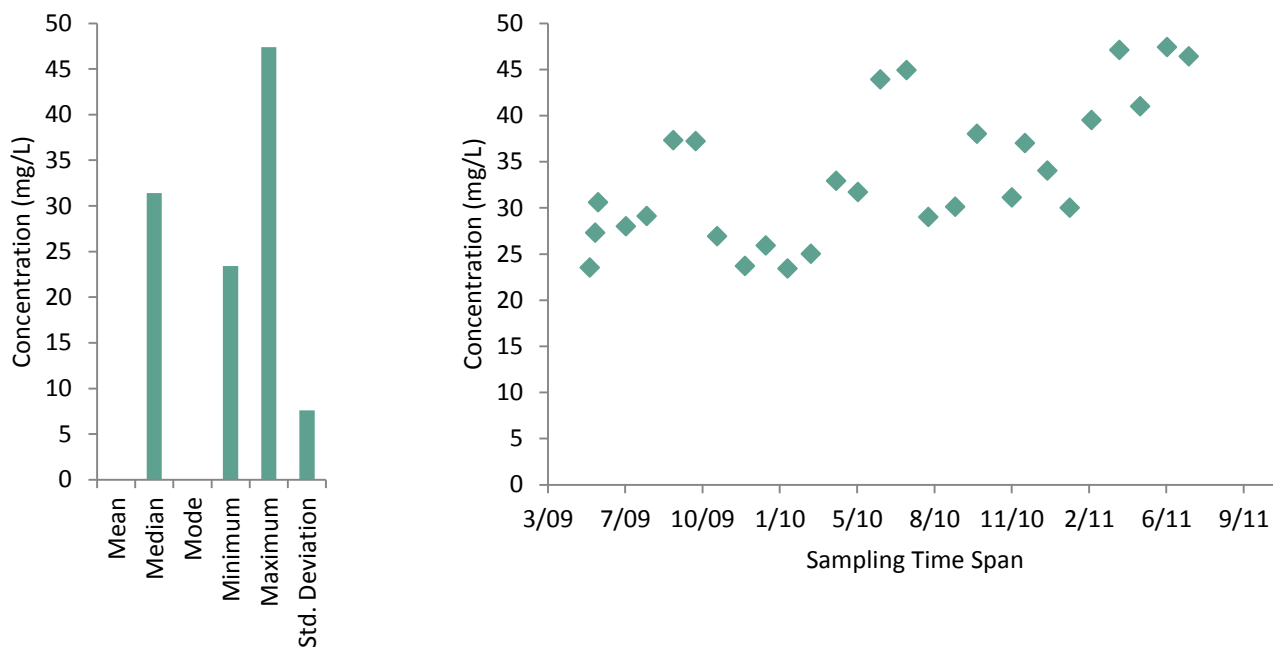
PPL Brunner Island, LLC

PA0008281

### 12.9.9 Fluoride

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median fluoride concentration of 31.4 mg/L. The Department's PENTOXSD model calculates a fluoride limit of "input value" at Q<sub>7-10</sub> conditions. Since fluoride is a concern at the public water supply intake, which is not expected to be impacted by this discharge, concentrations remain low given the size of discharge and receiving stream, and fluoride was not identified in EPA's Final Report as a pollutant of concern; therefore, fluoride is recommended for removal from the sampling regiment.

**Figure 12-15. Outfall 007 Fluoride Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

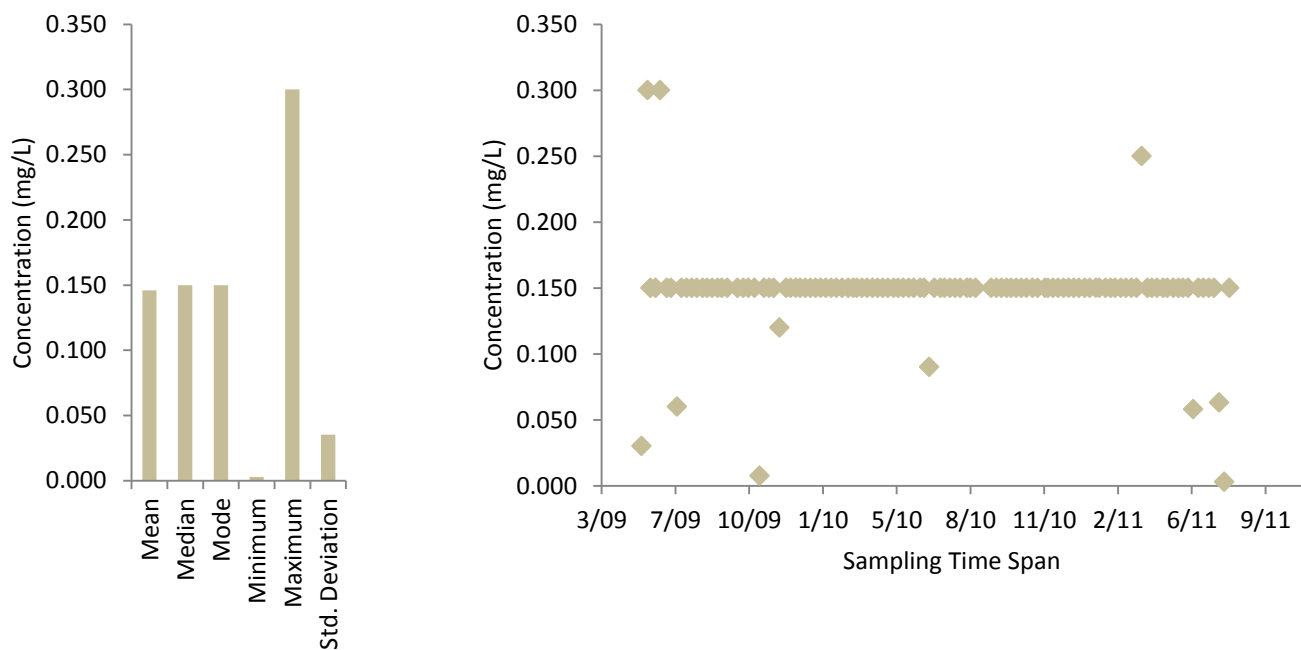
PPL Brunner Island, LLC

PA0008281

### 12.9.10 Lead

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median lead concentration of 0.15 mg/L. The Department's PENTOXSD model calculates a lead limit of 0.484 mg/L (Chronic Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent lead concentration is approximately 31% of the PENTOXSD result. Therefore, it is recommended that PPL Brunner Island continue to monitor and report the lead discharge concentrations with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-16. Outfall 007 Lead Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

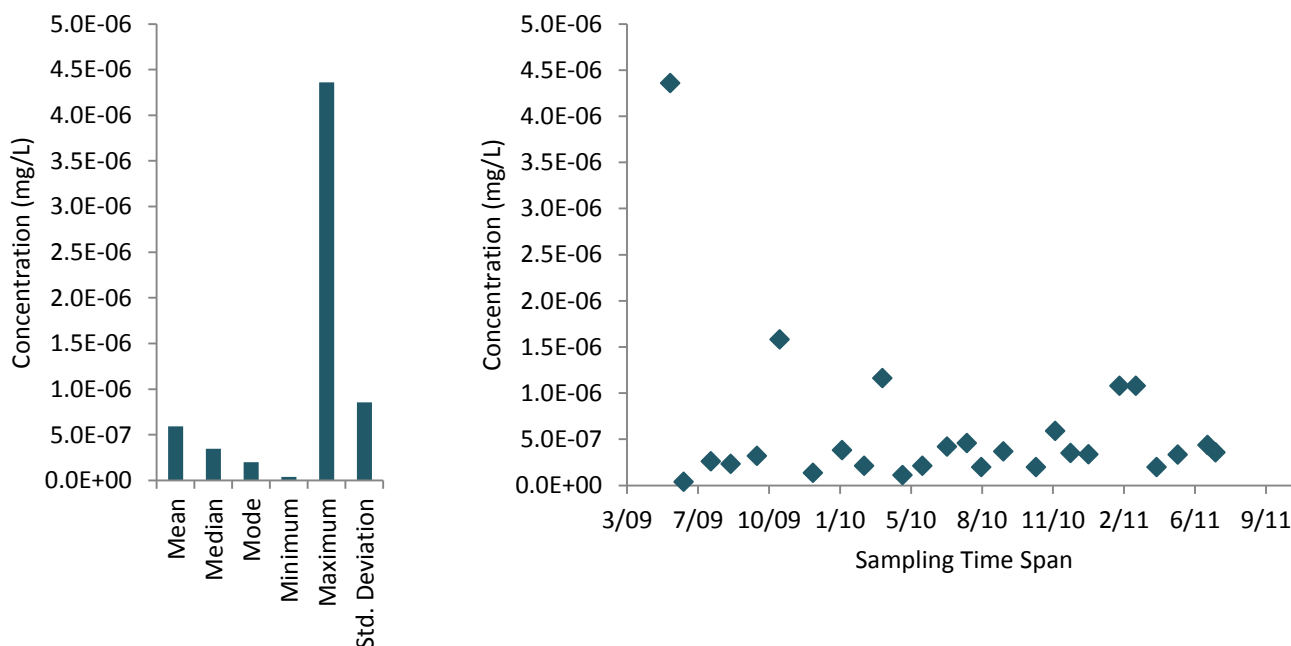
PPL Brunner Island, LLC

PA0008281

### 12.9.11 Mercury

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median mercury concentration of 0.000000345 mg/L. The Department's PENTOXSD model calculates a mercury limit of 0.007 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent mercury concentration is approximately 0.004% of the PENTOXSD result. Since mercury is a concern for human health and was identified as a parameter of concern in EPA's study of coal fired power plants, it is recommended that PPL Brunner Island continue to monitor and report the mercury discharge concentration with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

Figure 12-17. Outfall 007 Mercury Concentration Descriptive Statistics & Scatter Plot



## Water Quality Protection Report

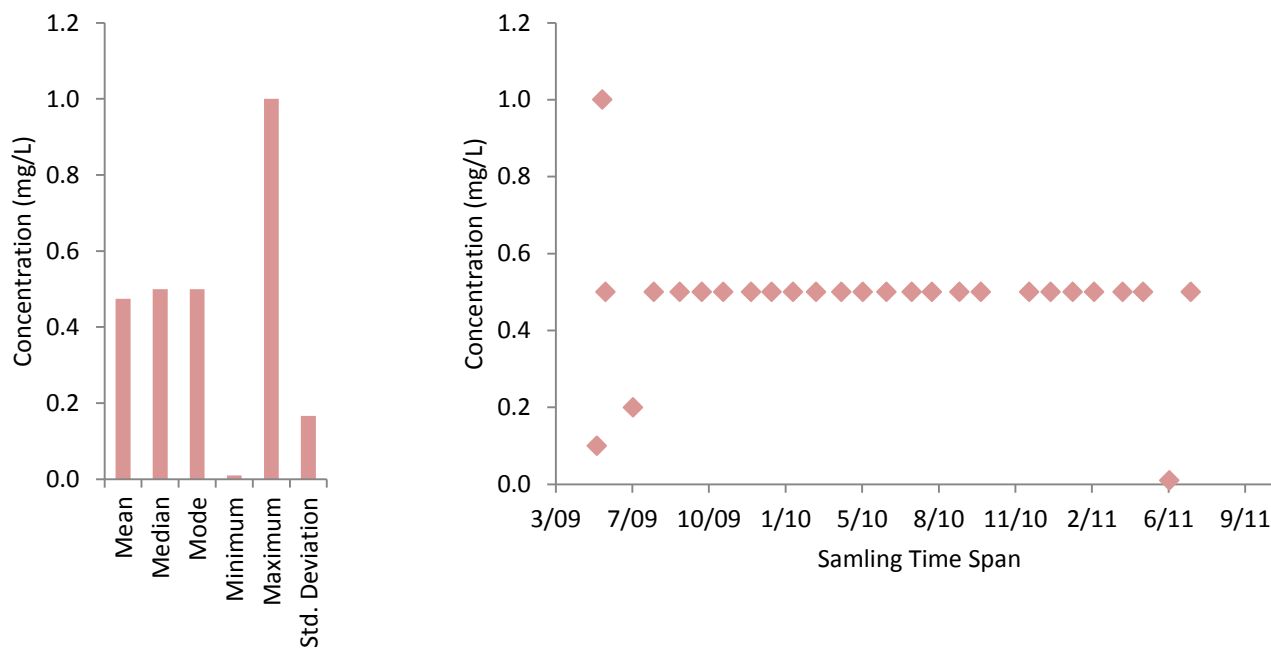
PPL Brunner Island, LLC

PA0008281

### 12.9.12 Molybdenum

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median molybdenum concentration of 0.50 mg/L. The Department's PENTOXSD model does not contain a criterion for molybdenum; however, the Department's technical staff in Central Office provided provisional molybdenum criteria of 0.210 µg/L (Human Health Criteria). The sampling data indicates PPL Brunner Island, LLC's median effluent molybdenum concentration is approximately 1.6% of the PENTOXSD result. This value when used in the PENTOXSD model, produces an effluent limit concentration of 32.007 mg/L. Since the median concentration remains low compared to the sample results and the current criteria is provisional, no limit is recommended. However, because the parameter is a concern to human health and the criteria is provisional, it is recommended that PPL Brunner Island, LLC continue to monitor and report molybdenum with a 24-hr composite type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-18. Outfall 007 Molybdenum Concentration Descriptive Statistics & Scatter Plot**





## Water Quality Protection Report

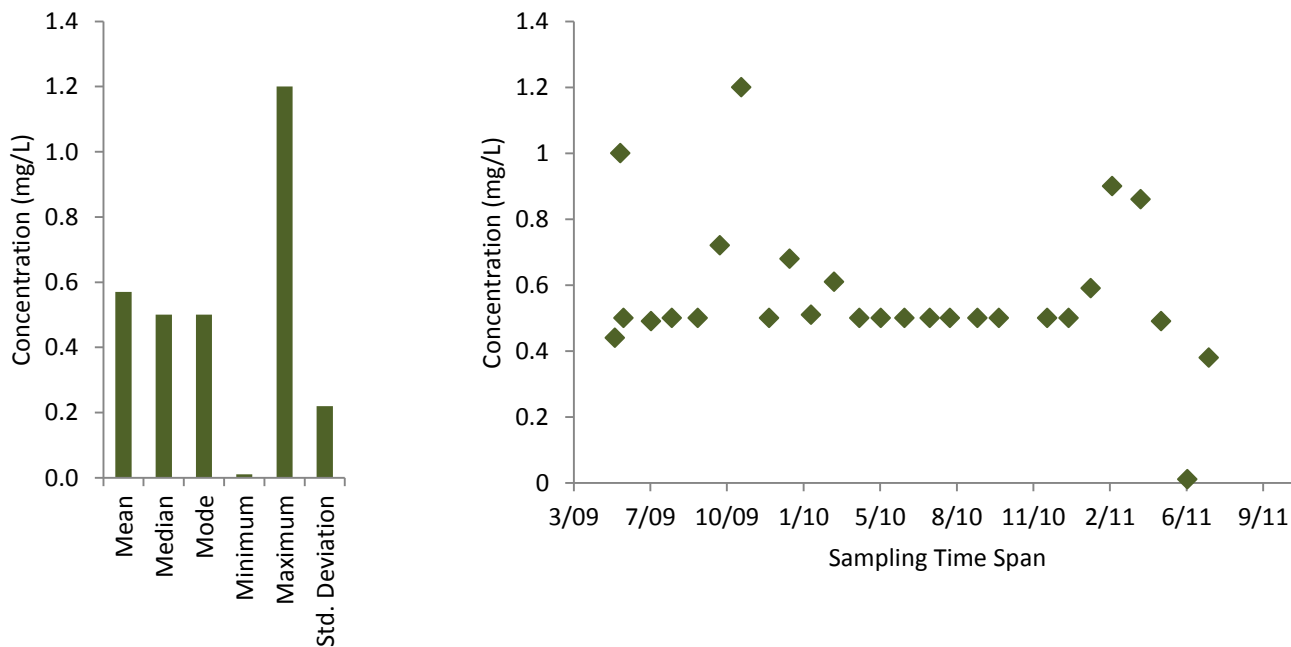
PPL Brunner Island, LLC

PA0008281

### 12.9.13 Nickel

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median nickel concentration of 0.50 mg/L. The Department's PENTOXSD model calculates a nickel limit of 6.87 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent nickel concentration is approximately 7.3% of the PENTOXSD result. To confirm that the nickel discharge concentration does not pose a threat to human health and per the Department's NPDES guidance document, no. 362-0400-001 (10/97), it is recommended that PPL Brunner Island perform sampling for an additional permit cycle on a weekly basis using a 24-hour composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-19. Outfall 007 Nickel Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

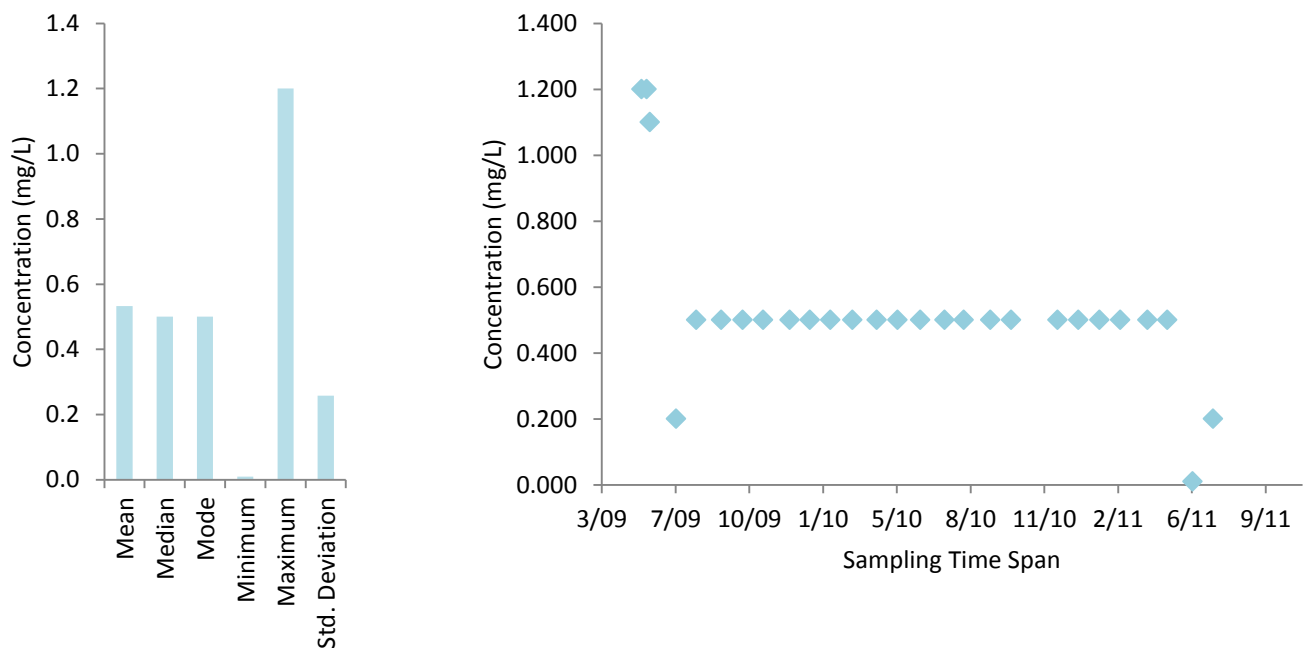
PPL Brunner Island, LLC

PA0008281

### 12.9.14 Selenium

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median selenium concentration of 0.50 mg/L. The Department's PENTOXSD model calculates a selenium limit of 0.760 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent selenium concentration is approximately 65.8% of the PENTOXSD result. Therefore, an average monthly selenium effluent limit of 0.760 mg/L is recommended with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-20. Outfall 007 Selenium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

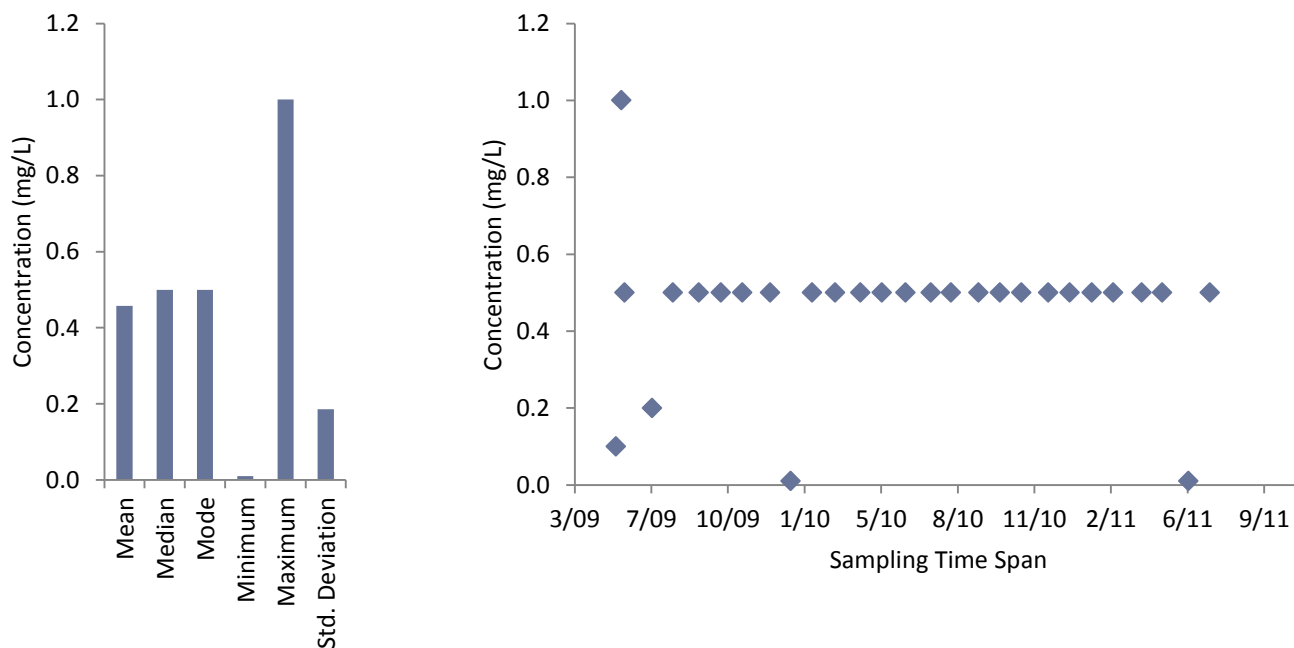
PPL Brunner Island, LLC

PA0008281

### 12.9.15 Thallium

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median thallium concentration of 0.50 mg/L. The Department's PENTOXSD model calculates a thallium limit of 0.036 mg/L (Human Health Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent selenium concentration is approximately 1388% of the PENTOXSD result. Since the grab samples indicate relatively high concentrations of Thallium as compared to the PENTOXSD results, an average monthly limit of 0.036 mg/L is recommended with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97). However, PPL Brunner Island will be given the option to perform a Toxicity Reduction Evaluation.

**Figure 12-21. Outfall 007 Thallium Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

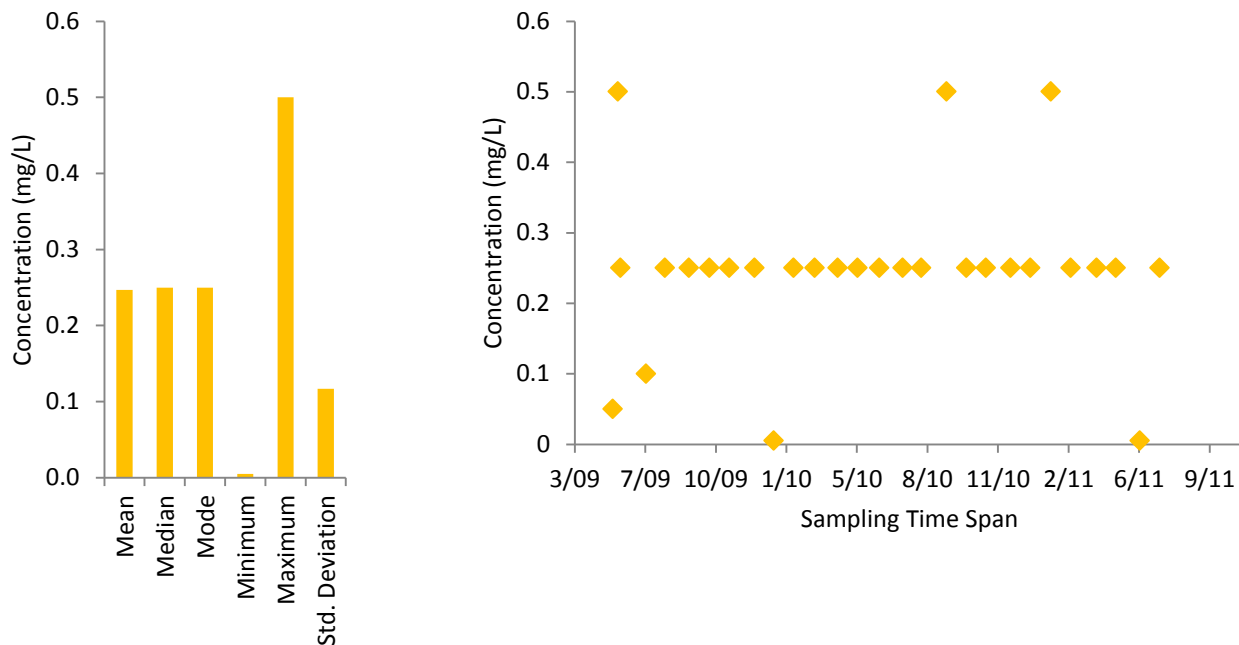
PPL Brunner Island, LLC

PA0008281

### 12.9.16 Zinc

PPL Brunner Island, LLC's grab sample results for the period from May 18<sup>th</sup>, 2009 to July 31<sup>st</sup>, 2011, shows a median zinc concentration of 0.25 mg/L. The Department's PENTOXSD model calculates a zinc limit of 1.75 mg/L (Acute Fish Criteria) at Q<sub>7-10</sub> conditions. The sampling data indicates PPL Brunner Island, LLC's median effluent zinc concentration is approximately 14% of the PENTOXSD result. Therefore, no zinc limit is recommended at this time; however, it is recommended that PPL BISES continue to monitor and report effluent zinc concentrations with a 24-hr composite sample type based on the Department's NPDES guidance document, no. 362-0400-001 (10/97).

**Figure 12-22. Outfall 007 Zinc Concentration Descriptive Statistics & Scatter Plot**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 12.10 Whole Effluent Toxicity Test (WET Test)

The PPL Brunner Island FGD IWTP discharge contains a variety of metals that are of concern for aquatic and human health. A WET Test is recommended for Outfall 007 based on the following factors:

- Metals concentrations approaching or already elevated beyond the PENTOXSD model results, such as Antimony, Boron, Cadmium and Copper.
- Elevated TDS (median value of 35,200 mg/L) and chloride (median value of 16,550 mg/L) concentrations.
- The FGD IWTP treatment processes focus on desulfurization and removal of suspended solids from the wastewater.
- Consideration of potential synergistic effects of several constituents.

The regulatory basis for this decision can be found in 40 CFR 122.44(d)(1)(v), which states the following:

“Except as provided in this sub-paragraph, when the permitting authority determines, using the procedures in paragraph (d)(1)(ii) of this section, toxicity testing data, or other information, that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative criterion within an applicable State water quality standard, the permit must contain effluent limits for whole effluent toxicity...”

Additionally, paragraph (d)(1)(ii) of the same federal code states the following:

“When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority shall use procedures which account for existing controls on point and nonpoint sources of pollution or pollutant parameter in the effluent, the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and where appropriate, the dilution of the effluent in the receiving water.”

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The Department's 1999 WETT *Implementation Procedures* document (WETT procedure) outlines the selection process for the Acute Test, Chronic Test and the determination of the Instream Waste Concentration (IWC). According to the WETT procedure, the IWC is defined as:

"The concentration of the effluent in the receiving stream at the compliance point expressed as a whole number percentage."

- i. Obtained the partial mix factor (PMF) for both acute and chronic from the Department's PENTOXSD model. The PMF for acute and chronic were 0.005 and 0.038, respectively.
- ii. Determined the acute IWC or  $IWC_a$  as follows:

$$IWC_a = [(Q_d \times 1.547) / ((Q_{7-10} \times PMF_a) + (Q_d \times 1.547))] \times 100\%$$

Note: The value of 1.547 is a conversion factor to change the discharge flow ( $Q_d$ ) from MGD to cfs.

$$IWC_a = [(0.520 \text{ MGD} \times 1.547) / ((3100 \times 0.005) + (0.520 \text{ MGD} \times 1.547))] \times 100\%$$

$$IWC_a = 4.93\%$$

- iii. The  $IWC_a$  is then divided by the acute criterion, 0.3 to determine the Target  $IWC_a$ .

$$\text{Target } IWC_a = 4.93\% / 0.3$$

$$\text{Target } IWC_a = 16.45\%$$

- iv. The  $IWC_a$  is lower than the established 110% threshold value according to the WETT procedure; therefore, PPL Brunner Island shall perform the Acute Test. The standard dilution series is used for the Acute Test and the dilution series is 100%, 50%, 25%, 12.5% and 6.25%. PPL Brunner Island should use the following organisms: *Pimephales promelas* and *Ceriodaphnia dubia*.

Based on the IWC equations provided in the Department's WETT procedure, PPL Brunner Island, LLC should perform an Acute Test with the standard dilution series.

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 12.11 Recommended Limits

**Table 12-4. Outfall 007 Recommended Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	2/month	Grab
TSS	XXX	XXX	30	XXX	100	1/week	24-hr comp
TDS	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Aluminum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Antimony	XXX	XXX	0.853	1.331	2.132	1/week	24-hr comp
Total Arsenic	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Boron	XXX	XXX	118.60	185.0	296.5	1/week	24-hr comp
Total Cadmium	XXX	XXX	0.031	0.048	0.077	1/week	24-hr comp
Hexavalent Chromium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Copper	XXX	XXX	0.205	0.319	0.512	1/week	24-hr comp
Total Iron	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Lead	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Mercury	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Molybdenum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Nickel	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

Total Selenium	XXX	XXX	0.760	1.185	1.90	1/week	24-hr comp
Total Thallium	XXX	XXX	0.036	0.057	0.09	1/week	24-hr comp
Total Zinc	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp

Parameter	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS	
	Mass Load		Concentrations			Minimum Measurement Frequency	Required Sample Type
	Monthly	Annual	Minimum	Monthly Average	Maximum		
Total Kjeldahl Nitrogen (TKN)	Report	XXX	XXX	Report	XXX	2/month	24-hour comp
Nitrate-Nitrite as N	Report	XXX	XXX	Report	XXX	2/month	24-hour comp
Total Nitrogen (Intake)	Report	XXX	XXX	Report	XXX	2/month	24-hour comp
Total Nitrogen (Effluent)	Report	Report	XXX	Report	XXX	2/month	24-hour comp
Net Total Nitrogen (Effluent) (Final)	Report	0	XXX	XXX	XXX	1/month	Calculate
Total Phosphorus (Intake)	Report	XXX	XXX	Report	XXX	2/month	24-hour comp
Total Phosphorus (Effluent)	Report	Report	XXX	Report	XXX	2/month	24-hour comp
Net Total Phosphorus (Effluent) (Final)	Report	0	XXX	XXX	XXX	1/month	Calculate



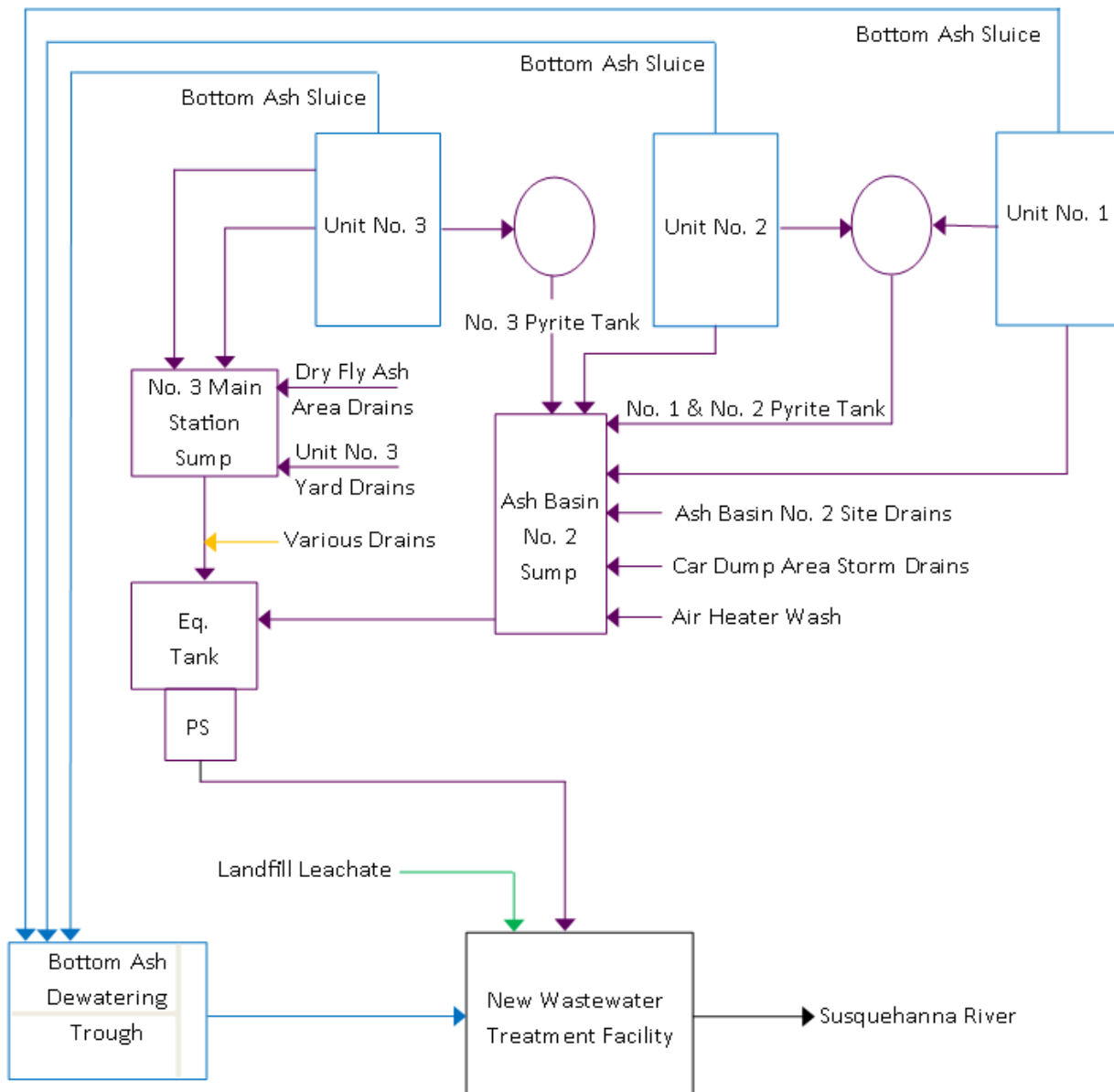
## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

### 13. Outfall 008- Industrial Wastewater Treatment Plant <sup>IWTP</sup>

The new outfall will discharge final effluent from a new IWTP currently being constructed by PPL Brunner Island, LLC to the Susquehanna River at an annual average flow of 5.5 MGD with a peak flow of 10.0 MGD. The new IWTP will allow PPL Brunner Island, LLC to eventually close out Ash Basin No. 4 and subsequently remove outfall 004. **Figure 13-1. Wastewater sources that flow to the new IWTP.**



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The IWTP is designed to only receive wastewater or sludge generated by onsite processes, such as landfill leachate, bottom ash sluice, pyrite tank overflow and precipitator wash water. The influent comes from four locations and each location serves as a collection point for wastewater and stormwater generated on site. The four locations are as follows:

- Equalization Basin – 3.2 MGD average daily flow
- Bottom Ash Troughs – 2.3 MGD average daily flow
- Landfill Leachate – 0.04 MGD average daily flow
- Wastewater Plant Recycle – Flow varies based on influent

The IWTP is designed to use a combination of pH adjustments and coagulation to treat the wastewater. Wastewater and stormwater entering the IWTB is treated as follows:

Influent Mix Tanks (2) → Sedimentation → Flocculator/Clarifiers (2) → Effluent Mix Tanks  
→ Discharge to new outfall

Since the new IWTP is designed to receive the flow that currently goes to Ash Basin No. 6, the recommended sampling requirements for the discharge to outfall 004 will be used for the new outfall for the IWTP. However given the volume of wastewater, wastewater characteristics and new treatment process it is recommended that PPL sample on a weekly basis. For additional information regarding the new IWTP system setup and operation please see the attached Internal Review and Recommendation **Attachment C**.

# Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

## 13.1 Recommended Limits

**Table 13-1. Outfall 008 Recommended Discharge Limits**

Parameter	Discharge Limitations					Monitoring Requirements	
	Mass Loadings (lbs/d)		Concentrations (mg/L)			Minimum Measurement Frequency	Required Sample Type
	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Instant. Maximum		
Flow (MGD)	XXX	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	From 6.0 to 9.0 S.U.			1/day	Grab
Oil & Grease	XXX	XXX	15	20	30	1/week	Grab
TSS	XXX	XXX	30	60	75	1/week	24-hr comp
Total Aluminum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Arsenic	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Boron	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Cadmium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Hexavalent Chromium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Copper	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Iron	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Lead	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Mercury	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Molybdenum	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Nickel	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Selenium	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp
Total Zinc	XXX	XXX	M&R	M&R	XXX	1/week	24-hr comp

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 14. Stormwater

The PPL Brunner Island current NPDES permit has 19 stormwater outfalls; however, only six are sampled as they were deemed representative of the site. Since PPL Brunner Island, LLC has built new facilities including the cooling towers and new IWTP, three additional stormwater outfalls have been requested for addition to the NPDES permit.

Currently, PPL Brunner Island samples stormwater outfalls 009, 013, 014, 015, 025 and 026. After reviewing the outfall locations and data, several outfalls are recommended for removal from the NPDES permit.

Stormwater outfall 009 does not appear to receive stormwater from active areas of operation. The collection area is located on the western side of the PPL Brunner Island property and based on a site visit (May 22, 2011) and an aerial photograph, it appears to collect stormwater from an access road to a golf course. The stormwater flows into a wetlands area; however, there is no physical outfall structure. The limited annual stormwater data (attached to the end of this report) is unremarkable; however, during the 2010 year PPL Brunner Island was unable to provide a sample for outfall 009. Since the stormwater generating area is outside of the active area of operation, the monitor and report requirements are recommended for removal.

The stormwater outfall 013 is the discharge point for the combination of outfall 012 and 014. Based on the annual DMR data from 2009 – 2011, the sampling data for the following parameters indicated varying concentrations: pH, Oil & Grease, Total Aluminum, Total Boron, Total Chromium, Total Copper, Total Iron, Total Lead and Total Zinc. The sampling for the following parameters indicated consistently low concentration levels: Total Arsenic, Total Cadmium, Total Molybdenum, Total Nickel, Total Selenium and Total Mercury. Since the sampling is performed on an annual basis and data is limited, it is recommended that PPL Brunner Island continue to monitor and report stormwater data on an annual basis.

The stormwater outfall 014 data from 2009 to 2010 was unremarkable, with iron and aluminum showing fluctuation in concentration; however, PPL Brunner Island was unable to sample in 2011. It is recommended that PPL Brunner Island continue annual sampling for outfall 014.

The stormwater outfall 015 data from 2009 was unremarkable. PPL Brunner Island was unable to sample in both 2010 and 2011. It is recommended that PPL Brunner Island continue annual sampling for outfall 015.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

The stormwater outfall 025 data from 2009 and 2011 was unremarkable. PPL Brunner Island was unable to sample in 2010. Based on a sight visit (May 22, 2011) and aerial photographs, the collection area is surface runoff from a capped and vegetative area that was previously an active ash basin. Since the area does not appear to currently be active, beside the access road around the general area, it is recommended that the monitor and report requirement be removed from the permit.

The stormwater outfall 026 data from 2009 and 2011 was unremarkable. PPL Brunner Island was unable to sample in 2010. It is recommended that PPL Brunner Island continue annual sampling for outfall 026.

### **15. Antidegradation**

Per 25 Pa. Code § 93.4c, the effluent limits for this discharge have been developed to ensure that existing instream water uses and the level of water quality necessary to protect the existing uses are maintained and protected. No High Quality Waters are impacted by this discharge. No Exceptional Value Waters are impacted by this discharge.

### **16. 303d Listed Stream**

The discharge is not located on a 303d listed stream segment.

### **17. Class A Wild Trout Fisheries**

No Class A Wild Trout Fisheries are impacted by this discharge.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

### 18. Reference Documents

Document No	Document Title
362-0400-001	NPDES – Technical Guidance for the Development and Specification of Effluent Limitations and Other Permit Conditions in NPDES Permits (10/1997)
391-2000-013	Implementation Guidance for Section 93.7 Ammonia Criteria (11/4/1997)
391-2000-007	Technical Reference Guide WQM 7.0 for Dissolved Oxygen and Ammonia Nitrogen Version 1.0 (7/26/2004)
391-2000-011	Technical Reference Guide PENNTOXSD for Windows PA Single Discharge Wasteload Allocation Program for Toxics Version 2.0 (5/22/2004)
391-2000-015	Implementation Guidance Total Residual Chlorine (TRC) Regulation (11/15/1994)
391-2000-023	Design Stream Flows (9/14/1998)
EPA 821-R-09-008	U.S.EPA Steam Electric Power Generating Point Source Category: Final Detailed Study Report (10/2009)

### Works Cited (12/17/12)

Agency for Toxic Substances and Disease Registry. "Public Health Statement Aluminum CAS# 7429-90-05."

*Agency for Toxic Substances and Disease Registry*. September 2006. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).

—. "Public Health Statement Aluminum CAS# 7429-90-05." *Agency for Toxic Substances and Disease Registry*. September 2006. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).

—. "Public Health Statement Antimony CAS# 7440-36-0." *Agency for Toxic Substances and Disease Registry*. December 1992. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).

—. "Public Health Statement Arsenic CAS# 7440-38-2." *Agency for Toxic Substances and Disease Registry*. August 2007. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- . "Public Health Statement Boron CAS# 7440-42-8." *Agency for Toxic Substances and Disease Registry*. November 2010. (accessed October 19, 2011).
  - . "Public Health Statement Cadmium CAS# 7440-43-9." *Agency for Toxic Substances and Disease Registry*. September 2008. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement CAS# 7439-97-6." *Agency for Toxic Substances and Disease Registry*. March 1999. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Chromium CAS# 7440-47-3." *Agency for Toxic Substances and Disease Registry*. August 2008. (accessed October 19, 2011).
  - . "Public Health Statement Copper CAS# 7440-50-8." *Agency for Toxic Substances and Disease Registry*. September 2004. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Lead CAS# 7439-92-3." *Agency for Toxic Substances and Disease Registry*. August 2007. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Nickel CAS# 7440-20-0." *Agency for Toxic Substances and Disease Registry*. August 2005. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Thallium CAS# 7440-28-0." *Agency for Toxic Substances and Disease Registry*. July 1992. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Zinc CAS# 7440-66-6." *Agency for Toxic Substances and Disease Registry*. August 2005. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Selenium CAS# 7782-49-2." *Agency for Toxic Substances and Disease Registry*. September 2003. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
  - . "Public Health Statement Fluorides CAS# Hydrogen Fluoride 7664-39-3 Fluorine 7782-41-4 Sodium Fluoride 7681-49-4." *Agency for Toxic Substances and Disease Registry*. September 2003. <http://www.atsdr.cdc.gov> (accessed October 19, 2011).
- Blumenstein, E. P., and J. J. Gusek. "Designing a Biochemical Reactor for Selenium and Thallium Removal from Bench Scale Testing Through Pilot Construction." n.d.
- . "Designing a Biochemical Reactor for Selenium and Thallium Removal, From Bench Scale Testing Through Pilot Construction." *Golder Associates Publications*. May 29, 2008. [www.golder.com](http://www.golder.com) (accessed September 14, 2012).

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- CH2M Hill (Sandy, P.E., Tom, Disante, P.E., Cindy) Prepared for North American Metals Council. *Review of Available Technologies for the Removal of Selenium from Water*. Technology Review, CH2M Hill, 2010.
- CH2M Hill. "EPRI Technical Manual: Guidance for Assessing Wastewater Impacts of FGD Scrubbers." *Electric Power Research Institute*. December 2006. <http://www.epri.com> (accessed June 20, 2012).
- . "PPL Generation, LLC Process Narrative for Instrumentation & Control for Brunner Island S.E.S Wastewater Treatment Plant East Manchester Township York County, Pennsylvania." CH2M Hill Project No. 380966, June 25, 2010.
- Degrémont Technologies. "Case Study PPL, Brunner Island Station Pennsylvania, United States (Flue Gas Desulfurization Wastewater Treatment System)." *Degrémont Technologies*. 2012. <http://www.degreмонт-technologies.com> (accessed October 31, 2012).
- . "Cast Study PPL, Montour Station Pennsylvania United States (Flue Gas Desulfurization Wastewater Treatment System)." *Degrémont Technologies*. 2012. <http://www.degreмонт-technologies.com> (accessed October 31, 2012).
- . *Degrémont Technologies News*. January 7, 2011. [www.degreмонт-technologies.com](http://www.degreмонт-technologies.com) (accessed November 13, 2012 ).
- . "Inflico iBIO Biological Wastewater Treatment System." *Degrémont Technologies*. 2011. [www.degreмонт-technologies.com](http://www.degreмонт-technologies.com) (accessed June 20, 2012).
- Department of Health and Human Services, Public Health Service Agency for Toxic Substances and Disease Registry. "Toxic Substance Portal - Substance Index for ToxFAQs." *Agency for Toxic Substance and Disease Registry*. November 2010. [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov) (accessed October 19, 2011).
- DePriest, William, Rajendra P. Gaikwad, and Sargent & Lundy LLC. "Graymont Search Results." *Graymont - Quality Lime and Stone Products*. n.d. [www.graymont.com](http://www.graymont.com) (accessed November 11, 2012).
- Eckenfelder, Jr., W. Wesley, Davis L. Ford, and Jr., Andrew J. Engle. *Industrial Water Quality*. New York: McGraw-Hill, 2009.
- Electric Power Research Institute. "The Fate of Mercury Absorbed in Flue Gas Desulfurization (FGD) Systems." *EPRI*. March 2005. [www.epri.com](http://www.epri.com) (accessed August 3, 2012).



## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- EPRI (prepared by Water Systems Specialists, Inc.). "Treatment Technology for Summar for Critical Pollutants of Concern in Power Plant Wastewaters." *EPRI*. January 2007. [www.epri.com](http://www.epri.com) (accessed November 16, 2012).
- GE Power & Water. "ABMet: Frequently Asked Questions." *GE Power & Water - Water & Process Technologies*. November 2009. [www.gewater.com](http://www.gewater.com) (accessed August 3, 2012).
- GE Water & Process Treatment. *Case Study Treatment of FGD Wastewater for Metals Removal 99%+ Removal of Selenium & Nitrate & metals*. Case Study, Trevoise, PA: General Electric Company, 2008.
- Golder Associates, Inc. *Literature Review of Treatment Technologies to Remove Selenium from Mining Influent Water*. Technology Literature Review, Lakewood, CO: Golder Associates, Inc., 2009.
- Goltz, Ph.D., Robert H, Naomi Levy, and Chris Eicher. "Degremont Technologies." *Technical Papers*. 2009. <http://www.degremont-technologies.com/dgtech.php?rubrique86> (accessed May 29, 2012).
- Goltz, Ph.D., Robert H., Chris Eicher, and Naomi Levy. "Technical Papers - A Zero Liquid Discharge Process for Boron Recovery from FGD Wastewater." *Degrémont Technologies*. 2009. [www.degermont-technologies.com](http://www.degermont-technologies.com) (accessed May 29, 2012).
- Higgins, PhD, PE, Thomas E, Thomas A Sandy PE, and Silas W Givens PE. "Flue Gas Desulfurization Wastewater Treatment Primer." *Power Business and Technology for the Global Power Industry*. March 1, 2009. [http://www.powermag.com/water/Flue-Gas-Desulfurization-Wastewater-Treatment-Primer\\_1739.html](http://www.powermag.com/water/Flue-Gas-Desulfurization-Wastewater-Treatment-Primer_1739.html) (accessed July 5, 2012).
- Owens, P.E., Mark, H. Robert Goltz, Ph.D., Dean Mingee, and Robert Kelly, Ph.D. "Trace Mercury Removal from Flue Gas Desulfurization Wastewater." *Degrémont Technologies*. n.d. (accessed May 29, 2012).
- Pa Department of Environmental Protection. *Internal Review and Recommendation GenOn Northeast Management Company*. WQM IR&R, Pittsburgh: Pa Department of Environmental Protection Southwest Regional Office, 2011.
- . "Pennsylvania Environmental Quality Board Final Amendments to Regulations on Wastewater Treatment Requirements Plain Language Summary." *Pennsylvania Department of Environmental Protection*. November 3, 2011. [www.depweb.state.pa.us](http://www.depweb.state.pa.us) (accessed November 4, 2011).
- Pa Department of Environmental Protection. *Water Quality Toxics Management Strategy*. Guidance, Harrisburg: Bureau of Water Standards and Facility Regulation, 2011.

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- Pa Department of Environmental Protection. *Water Quality Toxics Management Strategy 361-0100-003*. Harrisburg, PA: Bureau of Water Standards and Facility Regulations, 2011.
- Pa Department of Environmental Protection. "PPL FGD System Details." *Question/Response Document*. Harrisburg, PA: DEP SCRO, August 9, 2012.
- Pa. Department of Environmental Protection. *National Pollution Discharge Elimination System (NPDES) Technical Guidance for the Development and Specification of Effluent Limitations and Other Permit Conditions in NPDES Permits, Document No. 362-0400-001*. Harrisburg: Bureau of Water Quality Protection, 1997.
- PPL Corporation. "Conemaugh Steam Electric Station - At a Glance." *PPL Power that drives the economy and quality of life*. 2012. [www.pplweb.com](http://www.pplweb.com) (accessed November 20, 2012).
- . "PPL Montour How It Works." *PPL Generation Power that drives the economy and quality of life*. 2012. <http://www.pplweb.com/ppl-generation/ppl-montour/ppl-montour-how-it-works.aspx> (accessed October 31, 2012).
- . "PPL Montour Plant Fact Sheet." *PPL Generation Power that drives the economy and quality of life*. 2012. <http://www.pplweb.com/ppl-generation/ppl-montour/ppl-montour-plant-fact-sheet.aspx> (accessed October 31, 2012).
- PPL Generation, LLC. "CEMS Phase 1 Application." *Brunner Island Steam Electric Station Flue Gas Desulfurization Scrubber Project, Prepared for PPL Brunner Island LLC*. Allentown: PPL Generation, LLC, March 2008.
- Riffe, Michael R., Brian E. Heimbigner, Peter G. Kutzora, P.E., and Kenneth A. Braunstein, P.E. "Wastewater Treatment for FGD Purge Streams Paper #33." *MEGA Symposium*. Baltimore, MD, 2008. 23.
- Sawyer, Ph.D., Clair N., Sc.D., Perry L. McCarty, and Ph.D., Gene F. Parkin. *Chemistry for Environmental Engineering and Science 5th Edition*. New York, New York: McGraw-Hill, 2003.
- Sinha, Kumar, Collen Layman, Colleen Chapman, and Bechtel Power Corporation, Frederick, MD. "Environmentally Acceptable Treatment Options for FGD Wastewater." April 27, 2009. [www.adeq.state.ar.us](http://www.adeq.state.ar.us) (accessed August 3, 2012).
- Smith, Kyle, Antonio O. Lau, Ph.D., and Fredrick W. Vance, Ph.D. "Evaluation of Treatment Techniques for Selenium Removal IWC 09-05." *Degrémont Technologies*. 2009. [www.degremont-technologies.com](http://www.degremont-technologies.com) (accessed May 29, 2012).

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

- Sonstegard, Jill, James Harwood, Tim Pickett, and William Kennedy, P.E. *ABMet: Setting the Standard for Selenium Removal*. Study, Salt Lake City, UT: GE Water & Process Technologies & Orion Engineering, PLLC, 2009.
- Sonstegard, Jill, Tim Pickett, James Harwood, and Danny Johnson. "Full Scale Operation of GE ABMet Biological Technology for the Removal of Selenium from FGD Wastewaters." *GE Power & Water - Water & Process Technologies*. n.d. [www.gewater.com](http://www.gewater.com) (accessed August 3, 2012).
- Stover, Enos L., Michael Pudvay, Rober F. Kelly, Antonio O. Lau, and A. Paul (Shaw Env. & Infa.) Togna. "Technical Papers - Biological Treatment of Flue Gas Desulfurization Wastewater." *Degrémont Technologies*. n.d. <http://www.degremon-technologies.com> (accessed June 20, 2012).
- Tchobanoglous, Ph.D., P.E., George, Franklin L. Burton, P.E., H. David Stensel, Ph.D., P.E., and & Metcalf & Eddy. *Wastewater Engineering Treatment and Reuse, 4th Ed*. Boston: McrGraw-Hill, 2003.
- Twidwell, L. G., and C. Williams-Beam. "Potential Technologies For Removing Thallium From Mine and Process Wastewater: An Annotation Of The Literature." *Center for Advanced Mineral & Metallurgical Processing*. 2002. [www.camp-montanatech.com](http://www.camp-montanatech.com) (accessed September 14, 2012).
- U.S. Energy Information Administration. *Frequently Asked Questions - How much electricity does an American home use?* december 6, 2011. <http://www.eia.gov> (accessed December 5, 2012).
- U.S. Environmental Protection Agency. *Attachment A Technology-based Effluent Limits Flue Gas Desulfurization (FGD) Wastewater at Steam Electric Facilities*. Attachment/Guidance, Washington, D.C.: United State Environmental Protection Agency, 2009.
- U.S. Environmental Protection Agency. *Determination of Effluent Limits for Flue Gas Desulfurization (FGD) Wastewater at PSNH Merrimack Station Based on the Performance of Physical-Chemical Treatment Followed by Biological Treatment*. Statistical Analysis, Washington, D.C.: Office of Water Engineering and Analysis Division (4303T), 2011.
- U.S. Environmental Protection Agency. *Determination of Technology-Based Effluent Limits for the Flue Gas Desulfurization Wastewater at Merrimack Station in Bow, New Hampshire*. Fact Sheet, Boston: EPA Region 1, 2011. Available at <http://www.epa.gov/region1/npdes/merrimackstation/index.html> (accessed April 19, 2012).
- . "Development Document for Proposed Effluent Limitations Guidelines and Standards for the Centralized Waste Treatment Industry (EPA 821-R-98-020)." *Centralized Waste Treatment Development Document*. December 1998. <http://www.epa.gov> (accessed December 5, 2012).

## Water Quality Protection Report

PPL Brunner Island, LLC

PA0008281

---

U.S. Environmental Protection Agency. *Membrane Filtration Guidance (EPA 815-R-06-009)*. Guidance Document, Washington, D.C.: U.S. Environmental Protection Agency - Office of Water, 2005.

U.S. Environmental Protection Agency. *Steam Electric Power Generating Point Source Category: Final Detailed Study Report (EPA 821-R-09-008)*. Study, Washington, D.C.: United States Environmental Protection Agency, 2009.

—. *Technical Support Document*. Washington, D.C.: Office of Water, 1991.

Vaccari, David A., Peter F. Strom, and James E. Alleman. *Environmental Biology for Engineers and Scientists*. Hoboken: Wiley-Interscience, 2006.

Wylie, Robert, Richard Baker, William Kennedy, Michael Riffe, Brian Heimbigner, and Timothy Pickett. "Duke Energy Carolina LLC's Strategy and Initial Experience of FGD Waste Water Treatment Systems." *Siemens Power Industry Water and Wastewater Treatment*. October 2008. [www.water.siemens.com](http://www.water.siemens.com) (accessed June 20, 2012).